YUKON RIVER SALMON NEGOTIATION STUDIES
COMPLETION REPORT

NA03NMF4380185

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Prepared By

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and

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for

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INTRODUCTION

The United States and Canada began negotiations on Yukon River salmon upon signing the Pacific Salmon Treaty March 1985. In March 2001, after 16 years of negotiating, a long-term agreement was initialed; and in December 2002, representatives of both countries signed the Yukon River Agreement. The Agreement has as its principal goals to rebuild and conserve stocks and to provide benefits to the people of both countries who live along this river system. The purpose of this federally funded program is to help provide the technical support necessary to effectively manage the complex Yukon River salmon fisheries in the context of U.S./Canada treaty commitments, and to help provide support for the Yukon River Panel. Further, much of this information has become the cornerstone of the management of Canadian-origin salmon within the Yukon River drainage.

Allocation of the allowable harvest of salmon between the United States and Canada, combined with concerns for conserving specific stocks in a fully developed fishery harvesting from a mixture of stocks, makes the Yukon River a challenging salmon fishery to manage for optimum sustainable yields. Additional responsibilities are anticipated as agreements are put into effect. The Yukon River Joint Technical Committee (JTC) has determined the technical programs for both countries, is inadequate to meet the requirements under a treaty management regime. Continued development of an adequate field program is essential, this process requires travel support for participation in technical, government, and Panel meetings.

Meetings for the Yukon River Panel and meetings for the JTC are each held twice a year. Treaty implementation relies heavily on information supplied by the Alaska Department of Fish and Game (ADF&G) about the salmon fisheries and stocks in the Yukon River drainage. Some of that information has been gained because of specific appropriations from Congress passed through the Department of Commerce to ADF&G. Federal FY 2000-2002 funds were passed through to ADF&G to provide support for meeting costs and field data collection for the period July 1, 2003 through June 30, 2004 through grant Award No. NA03NMF4380185.

The purpose of the program supported by Federal funds for Yukon River salmon studies is to help provide the technical support necessary to effectively manage the complex Yukon River salmon fisheries in the context of the U.S./Canada negotiations, and now treaty implementation, process, and to provide support for the treaty implementation process. Specifically, Article VIII (3) makes the following requirements:

> The Parties shall initiate in 1985, and conclude, as soon as possible, negotiations to, *inter alia*,
>
> > (a) account for United States harvests of salmon originating in the Canadian section of the River;
> >
> > (b) develop co-operative management procedures, taking into account United States management programs for stocks originating in the United States section of the River;
> >
> > (c) consider co-operative research programs, enhancement opportunities, and exchanges of biological data; and

(d) develop an organizational structure to deal with Yukon River issues.

The Yukon River is the largest river in Alaska, and one of the largest in North America. It drains an area of approximately 330,000 square miles, nearly two-thirds of which is in Alaska. For perspective, the Yukon River drainage exceeds the combined areas of the U.S. Pacific coast states of Washington, Oregon, and California. The area is mostly remote, undeveloped, and in its natural pristine condition. The Yukon River supports one of the largest runs of Chinook and chum salmon in the world.

Providing harvest opportunity among the many users along the river in both the United States and Canada, and conserving specific stocks in a fully developed fishery harvesting from a mixture of stocks, makes the Yukon River one of the most challenging salmon fisheries to manage for optimum sustainable yields. The Yukon River Joint Technical Committee (JTC) has determined the technical program, for both countries, is inadequate to meet the requirements expected with a treaty management regime.

This report serves as a completion report in summary form for six field data collection projects or activities funded with this grant for the period July 1, 2000 through June 30, 2003. Specifically, the projects or activities described in this report are as follows:

1) JTC and Yukon Project Support
2) Chinook Salmon Stock Identification Using Scale Patterns Analysis (SPA)
3) Yukon River Salmon Stock Identification Using Genetic Stock Identification (GSI)
4) Subsistence and Personal Use Harvest Estimation
5) Spawning Escapement Surveys
6) Lower Yukon River Sonar at Pilot Station
7) Yukon Program Support
8) Sheenjek River Sonar
9) Yukon Radio Telemetry
10) Yukon Program Administrative Support.
11) Kantishna River Mark-Recapture

Results from each of these projects or activities will be summarized in the subsequent individual sections of this completion report. Reference will be provided to specific reports in preparation or already completed. These reports provide a more comprehensive source of information on the background for these projects or activities, the methods used, the results and discussion, and literature references. A comprehensive review of the Yukon River salmon fisheries and overall field programs can be found in Vania, et al. 2002.

LITERATURE CITED

Vania, Tom; et al. 2002. Annual Management Report Yukon and Northern Areas, 2000. RIR No. 3A02-29, Alaska Department of Fish and Game, Anchorage.

1. JTC AND YUKON PROJECT SUPPORT

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NA06FP0075
Period Covered by the Report: From: July1, 2003 To: June 30, 2004
Date Prepared: December 2004

II. Executive Summary

A Fishery Biologist II, Fishery Biologist IV and Analyst Programmer IV were supported by these funds to provide assistance to the successful completion of JTC meetings and projects listed in this grant. The Yukon River Joint Technical Committee was established in 1985 to provide professional and technical support for the treaty negotiations. JTC activities include research planning, setting of escapement goals, and preparing season outlooks for panel approval. Semi annual meetings of the JTC were scheduled and conducted in spring and fall of each year. Reviews and outlooks were presented, invited speakers presented their research and a JTC draft plan was produced. This project provides support for a Principal Investigator, experienced in conducting research, leading research planning, and carrying out scientific technical reviews. This project also provides funding for a team of biometricians, analyst programmers, or professional consultants for needed data processing, programming, and biometric support for the programs described in this document.

III. Purpose of Project

The Yukon River Joint Technical Committee (JTC) was established in 1985 to provide professional and technical support for the treaty negotiations. JTC activities include research planning, setting of escapement goals, and preparing season outlooks for panel approval. After the Yukon River Agreement was ratified in 2002, the JTC provides professional and technical support to the Yukon River Panel. Examples of annual analysis and data processing tasks include analysis of escapement trends, preseason projections, estimation of Canadian origin stocks, escapement goal estimation and rebuilding planning. Since inception of the JTC, technical subcommittees and teams have been established to address specific tasks. Examples of tasks accomplished in the last year are finishing a strategic plan for Yukon River salmon, technical review of proposals for funding under the Yukon River Salmon Restoration and Enhancement Fund, and a coordinated multi-year radio telemetry project.

The Fishery Biologist IV is the principal investigator for all the projects listed in this document. This position provides overarching support and supervision including review of all reports, audits and field visits to the project sites as necessary.

A team of biometricians, analyst programmers, or professional consultants provides needed data processing, programming, and biometric support for the programs included in the grant. This team provides consultation for each project to meet technical and statistical needs and reviews final reports for accuracy.

IV. Approach:

A Fishery Biologist II was funded to support JTC activities. Specifically, this position is responsible for the coordination and submission, in a timely manner, of the U.S. Section's

contributions to the semi-annual JTC reports and all other contributions from the U.S. Section of the JTC resulting from tasks assigned to the JTC. Additionally this position is responsible for the coordination of Yukon River Restoration and Enhancement Projects specified by the treaty and funded by the US federal government. This person made all travel arrangements for the meetings, and supported other Yukon US/Canada related projects in data analysis, planning and reporting.

Department staff members participated in U.S./Canada government-to-government meetings held in Anchorage, AK and Whitehorse, Yukon Territory. Staff made season review and season outlook presentations and distributed support materials. Many outside researchers were invited to speak to the JTC about their specialized research. Genetics researchers from various laboratories (ADF&G, USFWS, CDFO) were invited to a JTC meeting in March 2004 to present their research. NOAA, DFO and ADF&G staff presented information on the coordinated radio-telemetry project. This project is a good example of the excellent coordination between agencies and individuals to conduct a drainagewide project funded though various grantors.

This project provides support for a Principal Investigator experienced in conducting research, leading research planning, and carrying out scientific technical reviews. This position is co-chair of the JTC and oversees the US contributions to this body; cooperative research and scientific reports, and collaborates projects.

This project also provides funding for approximately one-half of the annual salary and benefits cost for a fulltime Analyst Programmer IV position in Anchorage. Although presented as a single position, a team of biometricians, analyst programmers, or professional consultants has provided needed data processing, programming, and biometric support for the programs described in this document.

V. Results, Evaluation and Conclusions

This project has successfully provided JTC Support. All the objectives stated in the scope of work are completed this year: travel to semi-annual JTC meetings, writing the JTC summary review and outlook reports, writing a JTC plan and establishing escapement objects. The JTC and the Panel met twice this year, spring and fall. Programs were evaluated, escapement goals were set and cooperative projects were coordinated. One positive result of JTC support has been the completion of the JTC Strategic Plan (McNeil 2004). The planning process began with Dr. Merritt's meetings in 2002. The JTC reworked this original plan by consolidating specific needs into more general objectives. The five original goals were consolidated into four: management, habitat, stewardship, and biology and ecology. Projects were listed and entered into the new plan under the appropriate issue, objective and goal. The JTC analyzed existing versus needed research projects for strategic gaps. Programs can now be developed to fill those gaps. The Principal Investigator is active in all aspects of the projects listed and is on the JTC planning committee. The data processing and biometrics team supports all the projects with data analysis, database management and data retrieval.

VI. Products

The Joint Technical Committee published three spring and three fall committee reports for the panel (Joint Technical Committee 2004). The spring reports provide information about outlooks for

the upcoming fishing season. Escapement targets for the Alaska Yukon border passage are recommended. The panel may revise these target numbers either up or down. Projects are updated. The fall reports are summaries of the season's fishing information, project updates and escapement estimates.

The JTC finished the strategic plan. The plan goals, objectives and issues are prioritized and have strategies for filling strategic information gaps. Projects were entered into the plan and the gap analysis was developed. Eventually programs to fill those gaps will be developed and supported. The plan and the planning process were explained to the Panel through a Power Point presentation.

VII. References

Joint Technical Committee. 2004. Yukon River Joint Technical Committee Report, Yukon River Salmon 2003 Season Review and 2004 Outlook. Regional Information Report No. 3A04-09, Alaska Department of Fish and Game. Anchorage, Alaska.

McNeil, Susan. 2004. *JTC Strategic Plan.* Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report No. 3A04-27. Anchorage, Alaska

VIII. Key Words: Yukon River, Chinook, chum, coho, salmon, border passage, Joint Technical Committee, Yukon River Panel, Pacific Salmon Treaty, Yukon River Agreement

2. CHINOOK SALMON STOCK IDENTIFICATION STUDIES USING SCALE PATTERN ANALYSIS (SPA)

Larry DuBois
Alaska Department of Fish and Game
NA06FP0075
Period Covered by the Report. From: July1, 2003 To: June 30, 2004
Date Prepared: December 2004

II. Executive Summary

Yukon River Chinook salmon *Oncorhynchus tshawytscha* (Walbum) are harvested in subsistence and personal use fisheries in Alaska, Aboriginal and domestic fisheries in Canada, and commercial and sport fisheries in both Alaska and Canada. Chinook salmon escapements indicate the largest concentrations of spawners occur in three distinct geographic regions. Chinook salmon stocks within these three geographic regions are collectively termed Lower, Middle, and Upper Yukon River stocks. These various stocks, or runs of origin, were sampled on or near the spawning grounds in the portions of the Yukon River drainage where they are assumed to be separate. Scales were taken from each fish sampled and these scale data were used to estimate the age composition at each sampling location. The scales of the more abundant age classes, typically age-5 (age-1.3) and age-6 (age-1.4) fish were digitized and a number of scale growth measurements were made on each scale. Maximum likelihood estimation models were used to estimate stock composition for the most abundant age classes. Observed age composition ratios among escapements, in combination with maximum likelihood estimates, were used to estimate stock composition of less abundant age classes. These data were assumed to characterize all salmon from each of the runs of origin. Similar data were collected from subsistence, test fish, and commercial catch samples. These proportions were then used to classify and apportion their associated harvests. The total estimated Yukon River harvest in 2002 was 76,677 Chinook salmon, of those, 19.4% were estimated to be of Lower, 29.2% Middle, and 51.4% Upper Yukon River stock group origin.

III. Purpose of Project

The Yukon River Chinook salmon run consists of a mixture of different stocks. Without knowing the age and sex composition and the timing of the stocks entry pattern into the river, managers are at risk of over harvesting less abundant stocks. Evaluating stock production, spawning escapement goals and management strategies of Yukon River Chinook salmon requires information on the age, sex, length, and stock compositions of the various harvests. Stocks of the three distinct geographic regions enter the mouth of the Yukon River at varying times within a constricted run time period. Over harvest of an individual stock over several years could reduce the overall productivity of that individual stock. In addition, the U.S. and Canada have been engaged in treaty negotiations concerning management and conservation of stocks spawning in Canada. Biological information on these stocks provides the technical basis for the negotiation process.

The objective of this project is to provide area managers with the estimated age and sex and a historical pattern of the stock composition of Chinook salmon entering the mouth of the Yukon

River throughout the season. Post season, the estimated contributions of the two Alaskan-origin and the single Canadian-origin Chinook salmon stocks to fishery harvests of the Yukon River drainage are provided. Additionally, the age, sex, and length compositions are estimated for harvests and escapements of Chinook salmon throughout the Yukon River drainage.

IV. Approach

Yukon River Chinook salmon were identified based on their geographic run of origin as Lower, Middle, and Upper River. The baselines for each run of origin were determined using scale pattern analysis (SPA) of Chinook salmon scale characteristics sampled from Alaskan tributary streams and Canadian fish wheels. These baselines were used to apportion harvests by run of origin in the mixed stock fisheries, such as mainstem commercial and subsistence harvests. The baselines for the two runs of origin within the Alaska portion of the Yukon River drainage, the Lower and Middle river runs were collected from pre-spawning Chinook salmon at tributary escapement projects and post-spawning carcass samples. Scales collected by the Canada Department of Fisheries and Oceans from test fish wheel catches in Canada, immediately upriver from the U.S.-Canada border were used for the Upper river run baseline. Lower river stocks originate in the tributaries that drain the Andreafsky Hills and Kaltag Mountains. Middle river stocks originate in the upper Koyukuk River and Tanana River tributaries. Upper river stocks originate in Canadian tributaries that drain the Pelly and Big Salmon Mountains, and the Canadian Yukon River mainstem.

Three scales were removed from each Chinook salmon and mounted on gummed cards and scale impressions were made into cellulose acetate using heat and pressure. These scale impressions were aged using a microfiche reader viewing at 40x magnification, and reported in European notation. After aging, selected scale impressions were converted to digital files by scanning, and measurements were made on these scale images using the OPTIMAS software program.

Mixed stock or non-baseline scale samples were collected from Yukon River Chinook salmon harvested in commercial, subsistence and test fisheries and tributary escapement projects throughout the drainage. The SPA program combines common characteristics from the digitized baseline samples and produces a maximum likelihood mixture model that assigns selected samples from the mixed stock harvests to Lower, Middle, and Upper river run of origin.

Various organizations participated in collecting age, sex, and length (ASL) data from Chinook salmon in the Yukon River drainage: Alaska Department of Fish and Game, Divisions of Commercial Fisheries and Sport Fish; United States Fish and Wildlife Service, Fairbanks Fishery Resource Office and Office of Subsistence Management; Emmonak Tribal Council, Bureau of Land Management, Bering Sea Fishermen's Association, City of Kaltag, Nulato Tribal Council, Tanana Chiefs Conference, and Department of Fisheries and Oceans, Canada.

A Fishery Biologist I and two seasonal Fish and Wildlife Technicians were supported by these funds to collect, process, and provide analysis of ASL data. Specifically, the Fishery Biologist I is responsible for overseeing ASL collecting and processing, and digitizing selected Chinook salmon scales. The Project Leader, a Fishery Biologist II was funded from other sources.

V. Results, Evaluation and Conclusions

During the time period covered by this completion report scale pattern analysis from the 2002 season was completed, ASL processing from the 2003 season was completed, and ASL collecting and processing from the 2004 season was begun.

In 2003, Chinook salmon ASL samples were collected from commercial, subsistence, test fishing, radio tagging, and escapement projects and provided ASL compositions and SPA information. Commercial harvest samples were collected from Districts 1, 2, 4, 5, and 6 and subsistence samples from Districts 1, 3, and 4. Samples used for scale pattern analysis were collected from the East Fork Andreafsky, Anvik, Gisasa, Chena, and Salcha Rivers and Henshaw Creek in Alaska, and from test fish wheels in Canada. Other escapement samples were collected from the Tozitna River. Usable samples collected from the Yukon River drainage numbered 11,251. Samples collected by project type were 3,207 from the commercial harvest, 643 from the subsistence harvest, 2,549 from Alaskan test fishing, 997 from radio tagging, 2,759 from Alaskan escapement and 1,096 from Canadian test fish wheels. These samples were aged and the results were tabulated in an unpublished report, *Salmon age & sex composition and mean lengths for the Yukon River Area, 2003*. Digitizing of Chinook salmon scales from the 2002 season was completed and a report published summarizing the stock composition of the harvest: *Origins of chinook salmon in the Yukon River fisheries, 2002.* Digitizing of Chinook salmon scales from the 2003 season is ongoing and a preliminary stock-allocation model for the 2003 fishing season was completed.

Sampling of Chinook salmon from the Lower Yukon River commercial, subsistence, and test fisheries in the 2004 season was initiated. These samples were aged inseason and preliminary age and sex tables were generated on a daily basis. Additionally, fin clips were collected from Chinook salmon harvested in the lower Yukon River fisheries for development of Genetic Stock Identification markers.

Results

A total of 76,677 Chinook salmon were harvested from the Yukon River drainage in 2002 (DuBois 2004a). The Upper stock group was the largest estimated component, contributing 39,387 fish, or 51.4% of the total. The Upper stock group harvest by country was 30,058 fish by the U.S. (76.3%) and 9,329 fish by Canada (23.7%). The Middle stock group was second in harvest abundance with an estimated 22,395 fish (29.2%). The Middle stock harvest proportion was the highest since 1984 and well above the historical average. The Lower stock group was the least abundant stock group in the total harvest contributing an estimated 14,895 fish (19.4%). This harvest was the second lowest on record for the Lower stock group.

Age composition of the Yukon River Chinook salmon commercial harvest in 2003 was estimated to be approximately 65.4% age-6, 26.1% age-5, 7.9% age-7, and 0.5% age-4 fish (DuBois 2004b). Age and sex composition for 92.2% of the total drainage harvest was estimated. Females accounted for 53.3% of the total harvest. All nine commercial fishing periods in the lower river during the 2003 summer season were restricted to 8-inch and larger mesh size gillnets. All five commercial periods were sampled in District 1, and two periods were sampled in District 2.

Similar to the commercial fisheries, age-6 fish dominated the samples collected from large mesh subsistence gear in the lower river (DuBois 2004b). Age-5 fish dominated the subsistence harvest samples from fish wheels in District 4. The percentage of females ranged from 8.9% in the fish wheel harvest to 57.6% in the subsistence harvest from large mesh gear.

Age composition from test fishing projects using large-mesh gear were similar to commercial and subsistence harvests; age-6 fish dominated the catch samples followed by age-5, age-7, and age-4 fish. The average age composition from five test fishing projects using 8.5-inch gear was: 68.0% age-6, 24.1% age-5, 7.2% age-7, and 0.6% age-4 fish (DuBois 2004b). The percentage of females from test fishing projects using large-mesh gear ranged from 45.6% to 54.4%. The fish wheels in Canada captured fewer females and older fish than other test fishing projects using gillnets. Samples from the Canadian fish wheels were composed of 48.1% age-5, 36.9% age-6, 11.2% age-4, and 3.8% age-7 fish. The percentage of females from the fish wheels was 27.6%.

Escapement age compositions were younger than those in the lower river commercial, subsistence, and test fisheries. The overall age composition from four weirs and three carcass-sampling projects was 51.6% age-5, 32.2% age-6, 12.7% age-4, 3.0% age-7, and 0.5% age-3 fish (DuBois 2004b). The overall percent of females was 37.6%, however, unweighted sex compositions from escapement samples showed the percent of females from carcass samples (average 41.7%) was greater than from weir samples (average 34.6%).

Evaluation and Conclusions

Prior to 2001, the stocks of origin from the commercial samples were usually applied to the subsistence harvests. The dedicated lower river subsistence harvest sampling that began in 2001 has continued through the 2004 field season, and the inseason ASL compositions from these samples are another tool available that fishery managers utilize when making inseason management decisions.

Yukon River fishery managers have historically needed an inseason assessment of Chinook salmon stock composition. Inseason assessment of stocks entering the Yukon River would provide Alaskan and Canadian managers an effective management tool. The mixed stock samples collected during the 2003 and 2004 field seasons for analysis using Genetic Stock Identification techniques may, with additional development, provide a tool for assessing inseason stock composition.

A preliminary stock allocation model was initiated before the 2004 field season. However, the final 2003 stock allocation model is still in progress because not all datasets have been digitized. The total estimated Yukon River Chinook salmon harvest in 2003 and estimates for assigning run of origin to this harvest are ongoing.

In terms of the overall project success, goals and objectives during this evaluation period were achieved. Attainment of sample size objectives has been considered to be a reasonable measure of operational success (Moore and Lingnau 2002). In 2003, sample sizes were judged adequate from most escapement and harvest sampling locations. Sample size objectives are designed to

ensure adequate numbers of scales from age-5 and age-6 fish are digitized for scale pattern analysis, and enough aged scales to describe age composition of the harvests and escapements. Larger sample size objectives from escapement sampling locations are required because these samples are from carcasses and live fish with longer migrations than the mixed stock samples. Escapement sample sizes appear to be adequate except for the Salcha River (n=151). Acceptable sample quality depends on environmental and biological factors, which are difficult to control, and sampling techniques, which can be controlled. For the data set size used in the analysis to remain acceptable, sampling techniques must be optimized. Less than adequate sample sizes can become problematic when developing a stock group model. Collection of good quality samples forms the foundation upon which this stock identification program rests.

VI. Products

Project results were reported in the following Regional Information Reports (RIR) and unpublished documents:

DuBois, L. 2004a. Origins of Chinook salmon in the Yukon River fisheries, 2002. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report No. 3A04-11, Anchorage.

DuBois, L. 2004b. Salmon age and sex composition and mean lengths for the Yukon River Area, 2003. Alaska Department of Fish and Game, Commercial Fisheries Division, *Unpublished*, Anchorage.

These reports were distributed to personnel with the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service and Canada Department of Fisheries and Oceans. Results have also been reported to the U.S./Canada Joint Technical Committees and Yukon River delegate members.

VII. References

DuBois, L. 2004a. Origins of Chinook salmon in the Yukon River fisheries, 2002. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report No. 3A04-11, Anchorage.

DuBois, L. 2004b. Salmon age and sex composition and mean lengths for the Yukon River Area, 2003. Alaska Department of Fish and Game, Commercial Fisheries Division, *Unpublished*, Anchorage.

Moore, H. and T.L. Lingnau. 2002. Origins of Chinook salmon in the Yukon River fisheries, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-30, Anchorage.

VIII. Key Words

Chinook salmon, *Oncorhynchus tshawytscha*, stock composition, Alaska, Canada, Yukon River, run of origin, age-sex-length sampling, commercial harvest, subsistence harvest, test fishing, escapement, fish wheel, weir, carcass; Lower, Middle, and Upper Yukon River stocks

3. YUKON RIVER SALMON STOCK IDENTIFICATION STUDIES USING GENETIC STOCK IDENTIFICATION (GSI)

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II. Executive Summary

Salmon stocks return to the mouth of the Yukon River in early June to spawn throughout the Yukon River drainage. The upriver migration of some stocks traverses the border into Canada where spawning sites are located in tributaries in Yukon and British Columbia. These salmon stocks, in both U.S. and Canadian portions of the drainage, are managed to reach the necessary escapement goals.

During the summers of 2003 and 2004, Chinook salmon were sampled from the commercial, subsistence, and test fisheries in the U.S. portion of the river. For management purposes, genetic stock identification (GSI) will be used to identify the stock composition of the samples collected to better understand the migration and run timing of the different components of Chinook salmon in the Yukon River.

ADF&G staff sampled chum salmon from test fishery at Emmonak, species-apportionment gillnetting research at the Pilot Station sonar site, and radio-tagged chum salmon at Russian Mission for archival. In addition, single nucleotide polymorphism (SNP) markers are being developed for stock identification of chum salmon in western Alaska and the Yukon River.

III. Purpose

Scale Pattern Analysis (SPA) has traditionally obtained information on the origin of Chinook salmon stocks harvested in the subsistence and commercial fisheries on the Yukon River. This method has shown acceptable levels of accuracy and precision, but it has several weaknesses: 1) the baseline must be sampled annually, 2) a limited set of populations represents the stock groups, and 3) stock-composition estimates require scales from salmon on the spawning grounds and are, therefore, only available post season. Recent advances in genetic techniques have shown promise in delivering the same information in a timely manner with improved stock resolution.

Chum salmon entering the Yukon River after July 15 are considered fall run for purposes of inseason management. Abundance estimates for fall-run chum salmon are derived by summing Pilot Station sonar passage estimates from July 18 forward (three day migration time from mouth of river to sonar site) with subsistence and commercial harvests of fall- run chum salmon down stream from Pilot Station. Use of abundance estimates is an integral part of the management of fall-run chum salmon in the Yukon River; these data are used in part to open and close

subsistence and commercial fisheries, achieve escapement goals, and meet agreed passage levels into Canada.

In 1999, ADF&G implemented a study to use genetic stock identification to estimate the migration timing of summer- and fall-run chum salmon entering the Yukon River. Current archival chum salmon collections will further compliment the previous studies from 1999 through 2002. These axillary process clips in ethanol will be archived by the ADFG Gene Conservation Laboratory for future genetic stock identification and assayed with single nucleotide polymorphism (SNP) markers (Smith et al. in press). To date, thirteen SNPs have been developed for high throughput assays in Western Alaska, and we are presently evaluating 25 additional loci.

IV. Approach

Tissue collections

Chinook salmon - Chinook salmon harvested in the subsistence, commercial and test fisheries in the U.S. portion of the Yukon River were sampled during the 2003 and 2004 field seasons.
In 2003, sampling goals were to collect tissues from every Chinook salmon encountered in the Pilot Station species apportionment fishery and as part of the radio telemetry project at Russian Mission. In addition, 500 Chinook salmon were to be sampled from the test fishery in Emmonak.

In 2004, sampling goals were as follows; 800 Subsistence, 3760 Commercial, 500 Test Fish, 1400 Radio Telemetry, and 198 Yukon border stocks. Due to an exceptional fire season, the sampling goals for the border stocks were not met. ADF&G staff and field crew collected Chinook salmon samples from June 4 to mid August. The tissues collected from Chinook salmon during the 2003 and 2004 field seasons were axillary process "spines" and scales from individual fish preserved in ethanol or on gum cards, respectively. Samples collected during this time are listed in Table 1. One hundred SNPs have been identified in Chinook salmon. Of these, 19 have been developed for high-throughput analyses and are being surveyed in the Yukon River populations. The genotyping assays are easy to standardize across laboratories (these are presently being used in the NMFS Auke Bay laboratory and the Columbia River Inter-Tribal Fisheries Commission genetics laboratory), and the resulting genotype data are readily combined across laboratories. A peer-reviewed manuscript describing several of these assays is in press (Smith et al., see below). We generated a genetic baseline using nine of these SNP markers by applying them to the over 3000 samples from 22 collections that comprise the current baseline collections. Simulations and analyses of known fish suggested that the SNP baseline could be used to assign fish to country of origin with >95% accuracy. We then applied the SNPs to mixture samples taken from Pilot Station and Emmonak in 2003 and used mixed stock analysis to allocate the mixture samples to baseline collections and populations. A description of this baseline and a demonstration of its power for estimating the proportion of U.S. and Canadian Chinook salmon caught in Yukon River fisheries are presently under review for publication in the North American Journal of Fisheries Management.

Chum salmon - During the period covered by this study, chum salmon tissues were collected from test fisheries in the Yukon River drainage at Pilot Station (river km 197) from 28 June to 30 July 2003 and 6 June to 16 July 2004. A goal of 200 individuals per week was set for the Pilot

Station test fishery collections. Fish were sampled from species apportionment sampling conducted twice daily at the sonar site at Pilot Station run by ADF&G. Axillary process tissues were sub-sampled from 30 individuals from each sampling period, placed in labeled cryovials pre-filled with ethanol as preservative. All tissue samples were shipped to the ADF&G Gene Conservation Laboratory for archival storage. When incidental catch of chum salmon in the Pilot Station test fishery was below target levels, every fish caught was sampled for genetic stock identification.

Laboratory Analysis

We have identified over 100 single nucleotide polymorphisms (SNPs) in Chinook salmon and have developed high-throughput genotyping assays for 19 of these. Using these assays a single technician can generate thousands of genotypes per day. The genotyping assays are easy to standardize across laboratories (these are presently being used in the NMFS Auke Bay laboratory and the Columbia River Inter-Tribal Fisheries Commission genetics laboratory), and the resulting genotype data are readily combined across laboratories. A peer-reviewed manuscript describing several of these assays is in press (Smith et al., see below).

V. Findings

Baseline Analysis

We generated a genetic baseline for Chinook salmon SNP markers by applying nine of them to over 3000 samples from 22 collections. Simulations and analyses of known fish suggested that the SNP baseline could be used to assign fish to country of origin with >95% accuracy. We then applied the SNPs to mixture samples taken from Pilot Station and Emmonak and used the baseline to allocate the mixture samples to baseline collections and populations. A description of this baseline and a demonstration of its power for estimating the proportion of U.S. and Canadian Chinook salmon caught in Yukon River fisheries are presently under review for publication in the North American Journal of Fisheries Management (Smith et al. *in press*).

No additional information is available for chum salmon.

VI. Evaluation

We are developing markers based on the 5'-nuclease reaction to genotype single nucleotide polymorphisms (SNPs) in large number of chum salmon. These markers are being developed in order to utilize the wealth of previously described polymorphisms that have not been applied on large scales due to throughput constraints of older methodologies. Results to date clearly show that SNP genotyping is a rapid, cost effective, and high-resolution approach to baseline development and to the analysis of large numbers of samples from complex mixtures. Time and monetary requirements for running SNP genotyping assays are low relative to other classes of genetic markers, and these assays are standardized across laboratories and platforms much more readily than are those for other genetic marker classes.

We anticipate that SNPs along with existing genetic markers will become an increasingly important tool for stock identification studies of both Chinook salmon and chum salmon in Western Alaska and on the high seas. Questions such as relative contribution to fisheries, relative

abundance, timing and migratory patterns as well as timing of juvenile outmigrations will be able to be addressed.

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VIII. Key Words:

Chinook salmon, chum salmon, Yukon River, single nucleotide polymorphisms (SNPs), commercial fishery, subsistence fishery, stock composition, stock identification.

Year	Fishery	Location	Tissue type	Sample size
Chinook				
2003	**Test Fishery**	Emmonak	fin clip	486
	Research	Pilot Station sonar site	muscle,fin	668
	Radio Telemetry	Russian Mission	axillary	1090
				2244
2004	**Commercial**			
	Y1	Emmonak	axillary	400
		Emmonak	axillary	400
		Emmonak	axillary	400
		Emmonak	axillary	400
		Emmonak	scale	400
		Emmonak	scale	200
		Emmonak	scale	190
		Emmonak	scale	54
				2444
	Y2	St. Mary's	axillary	400
		St. Mary's	axillary	400
		St. Mary's	axillary	400
		St. Mary's	scale	400
				1600
	Y5	Tanana/Border	axillary	480
	Y6	Upper Tanana	axillary	480
	Test Fishery			
	Y1	Emmonak	axillary	474
	Subsistence			
	Y1	Emmonak	axillary	400
	Y4	Kaltag	axillary	303
	Radio Telemetry			
		Russian Mission	axillary	1300
		Russian Mission Archival	axillary	100
				1400
Chum				
2003	**Test Fishery**			
	Y1	Big Eddy - Emmonak	fin clip	300
		Middle Mouth - Emmonak	fin clip	300
				600
	Research	Pilot Station sonar site	fin clip	1700

2004	**Research**	Pilot Station sonar site	axillary	1159

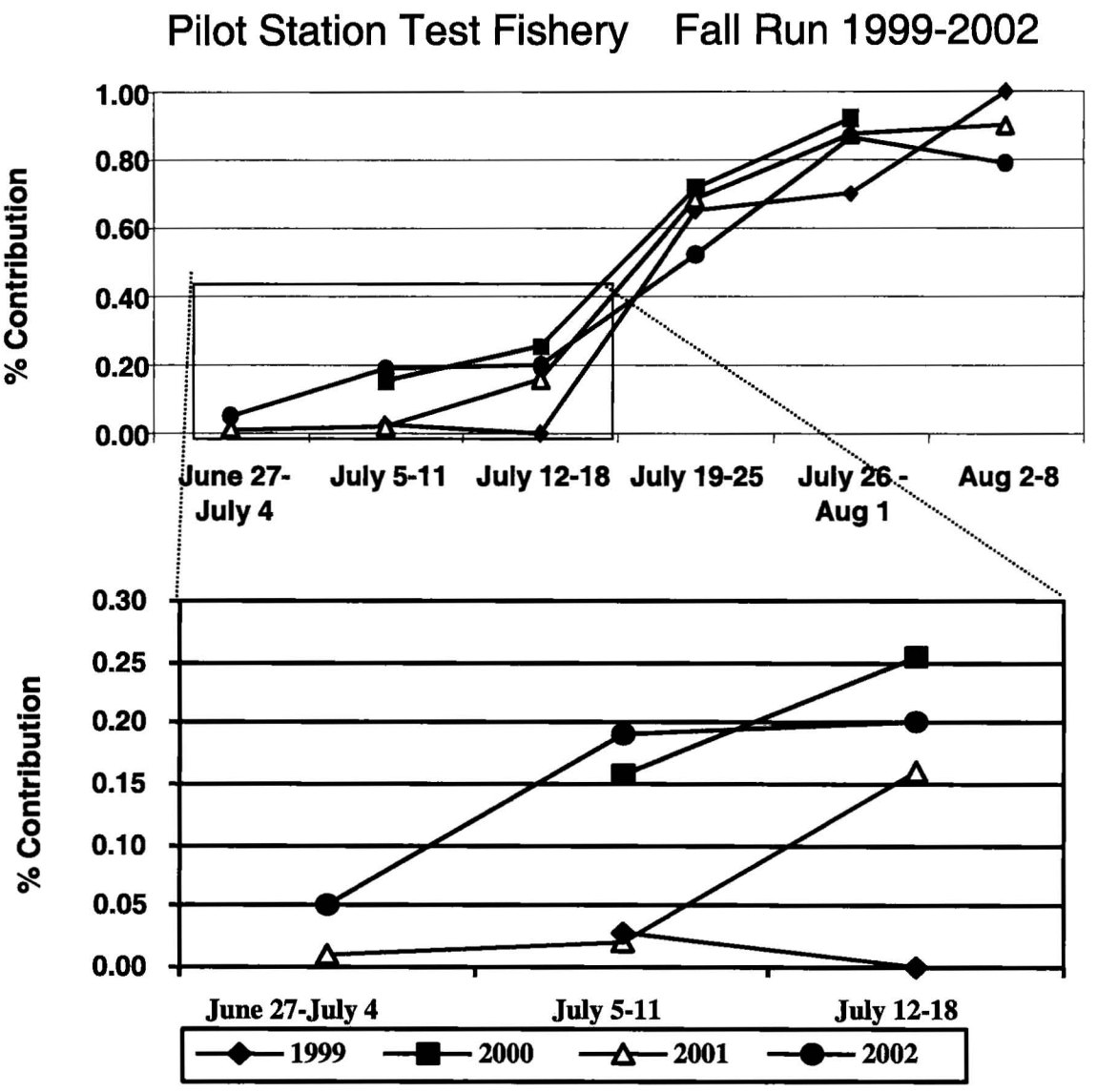

Figure 4. Contribution of fall run, 1999-2002.
a. June-August
b. Expanded view of June 27 to July 18

	Radio Telemetry	Russian Mission	axillary	300

4. SUBSISTENCE AND PERSONAL USE SALMON HARVEST ESTIMATION

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Division of Commercial Fisheries, Alaska Department of Fish and Game
NA06FP0075
Period Covered by the Report: July 1, 2003 to June 30, 2004
Date Prepared: December 2004

II. Executive Summary:

The Yukon Area subsistence salmon harvests are the largest in the state. The Alaska Department of Fish and Game (ADF&G) subsistence program provides annual estimates of subsistence and personal use salmon harvests within the Yukon Area. This harvest estimate is compiled using information from fishing permit harvests, estimates of fish provided by test fisheries for subsistence use, as well as stratified random sampling techniques for surveyed communities. Demographic information is collected to provide an estimate of the number of households participating in the fishery, the number of people in the Yukon Area, the number of dogs, gear types utilized and areas fished.

III. Purpose of Project:

The State of Alaska is mandated by the Board of Fisheries (BOF) to provide adequate escapement of salmon to spawning grounds and to provide for harvests in subsistence, sport, personal use, and commercial fisheries, of which subsistence has the highest priority. Harvest estimates are required in order to allocate and manage salmon. At this time, salmon returning to the Yukon River drainage are fully allocated between the various fisheries, including both the U.S. and Canadian fisheries. Additionally, families in the Yukon Area communities are dependent upon the return of salmon to provide a natural food source. Insufficient salmon returns to the Yukon Area result in both economic and natural disaster.

Objectives:

1. Estimate the subsistence and personal use salmon harvests within the Yukon Area.
2. Estimate select demographics, including the number of people in households and number of fishing households in the Yukon Area.
3. Estimate the primary gear type utilized by fishermen participating in the Yukon Area fishery.
4. Estimate the number of dogs, number of households with dogs, number of households that feed fish to dogs, and number of salmon fed to dogs.
5. Document the harvest of non-salmon fish utilized by Yukon Area the communities.

III. Approach:

Subsistence Harvest Survey: The household list for surveyed communities is updated annually, based on the previous year's fieldwork and most current Permanent Fund Dividend register. The households to be surveyed in 34 communities are selected as a stratified random sample. Survey methods include post-season door-to-door personal interviews, as well as harvest information provided on calendars, and telephone interviews. Prior to the fishing season, a mass mail out of salmon harvest calendars and a detailed letter providing the previous year's results by community

is distributed to approximately 2,500 households. The mail out list is generated from household lists compiled following the previous year's survey.

Each year post-season salmon surveys begin in the Lower Yukon Area in September and in the Upper Yukon Area in October. The surveys are conducted immediately following the end of the fishing season while fishermen can easily remember their salmon harvest. Due to the length of salmon migration routes, it takes a month for fish to reach the upper portion of the drainage. Survey data is edited and entered into the database from November through January.

Subsistence and Personal Use Permits: Subsistence or personal use fishing permits are required in some portions of the Upper Yukon Area. The permits are issued by mail or in person at the ADF&G office. ADF&G personnel travel to approximately eleven communities annually to issue the fishing permits and to contact fishermen. On average, 480 permits are issued each year, primarily from the Fairbanks office. A summary letter containing results from the previous year's harvests and a summary of the regulations required for the particular permit area are provided with each permit issued. Information from the permits is entered inseason into a database. A current Permit Holder's Household List is maintained inseason and is available to provide data for mass mail outs when management actions deem it necessary. Permit holders in a portion of the Tanana River near Fairbanks are required to telephone in their salmon harvests each week for use as an inseason management tool. Additionally, telephone-reporting requirements provide harvest numbers for the personal use area that has a harvest limit.

Upon return of the permits, harvests are entered into a database by species and by harvest date. Additionally, ADF&G staff concentrates on retrieving fishing permits, most of which expire October 15. Delinquent permit holders are notified in two separate mailings to return their harvest permits, and follow up telephone calls may be conducted, if necessary, to finalize data.

Once the survey results and permit harvest information are entered into the databases, additional edit checks are conducted prior to running the expansion, which usually occurs in January and February. The draft Regional Informational Report (RIR) is generally produced in March and comments are put together for the final report due out in April. In April the survey and permit databases are once again updated, and the new list of households is provided for preseason mail outs beginning in May. In 2003, however, the timeline for data analysis and the 2003 RIR final report was delayed. This was largely due a conversion of the subsistence database format from R-Base to Access, new staffing, and work conflicts and obligations during the 2004 fisheries.

Project management:
Fishery Biologist II, Project Leader: Responsible for project management budget, data analysis, and report writing. Funding provided by other source.
Biometrician II, Data Analysis: provides the expansion and random sample selection. Funding provided by other source.
Analyst Programmer III: Develop and maintain survey and calendar databases, and maintains the household list. Funding provided by other source.
Fish and Wildlife Technician III, Survey Crew Leader: Responsible for survey preparations, including radio announcements and posters sent to communities prior to conducting surveys,

logistics support, data editing, and data entry. This funding source provides approximately four and one half months salary annually.

Two Fish and Wildlife Technician II's, Yukon Surveyors: Travel between communities conducting annual surveys. This funding source provides approximately two months salary, overtime, and travel expenses each annually.

Fishery Biologist I, Permit and Report Support: Issues, recovers and compiles permit information as well as formats final report tables. This funding source provides approximately four months salary annually.

Fish and Game Program Technician, Calendar and Report Support: Designs and produces calendars in Corel Draw, arrange bulk mail-outs, report editing, as well as administrative support. Funding provided by other source.

Tribal and City Office Workers: Provide their time to review and keep current maps of the communities and household lists. Funding provided by other source.

Village helpers: Provides their time and equipment to assist surveyors. This funding source provides compensation for fuel or transportation cost while assisting surveyors.

V. Results, Evaluation and Conclusions:

Results: To finalize and produce the 2003 Regional Information Report (RIR) annual report of estimated subsistence and personal use salmon harvests within the Yukon Area. Although no further changes are anticipated, harvest estimates presented in Table 1 are considered preliminary.

In 2003, the Yukon Area subsistence and personal use harvest of Chinook salmon was estimated to be 56,936. This is the third highest harvest since 1992, nine percent above the recent ten-year average of 45,100 fish. Despite this increase, overall the subsistence and personal use salmon harvests have recently been declining. This is due to the reduction or absence of commercial fishing for summer chum salmon in the middle Yukon, the area that normally contributes the highest levels of harvest. Poor returns and poor commercial markets have hampered the summer chum salmon fishery. For example the 2003 subsistence harvest estimate of 82,272 summer chum salmon was 20 percent below the recent ten-year average of approximately 103,300 fish, and 36 percent below the more typical six-year average (1992 to 1997) harvest of approximately 127,700 fish. Because of poor fall chum salmon run sizes, fishery restrictions or fishery closures that were in place during the fall salmon seasons in the years of 1993, 1998, and 2000 to 2003. The estimated subsistence and personal use harvest of fall chum salmon in those years was reflective of the poor runs. In 2003, the fall chum salmon run showed significant improvement, as was evident by the estimated subsistence harvest of 56,912 fall chum salmon, 56 percent above the recent three year average (2000-2002). This, however, is still 51 percent below the five-year average (1992, 1994 to 1997) harvest during more typical years of approximately 117,300 fall chum salmon. The estimated subsistence and personal use harvest of coho salmon also declined in those years of poor fall chum salmon harvests since management actions affected both species due to run timing. In 2003, in spite of a record high coho salmon run, subsistence estimated harvest was still 32 percent below the more typical five-year average harvest.

Table 1. (Preliminary) Subsistence and personal use salmon harvest estimates which include test fish harvests provided for subsistence use, and related information, Yukon Area, 2003.

Community a	Survey Date or Permit Village	Number of Fishing Households b	Number of Dogs	Estimated Harvest				Primary Gear Used c		
				Chinook	Summer Chum	Fall Chum	Coho	Set Gillnet	Drift Gillnet	Fish Wheels
Hooper Bay	9/12-15	140	291	722	10,658	40	244	44	0	0
Scammon Bay	9/11	50	74	1,128	3,310	106	48	22	0	0
Coastal District Total		**190**	**365**	**1,850**	**13,968**	**146**	**292**	**66**	**0**	**0**
Nunam Iqua d	9/10-11	26	41	925	2,561	127	117	18	0	0
Alakanuk	9/7-10	78	141	*1,707*	*5,287*	348	193	15	8	0
Emmonak	9/6-8	76	194	*2,763*	*7,644*	*1,257*	*547*	17	38	0
Kotlik	9/8-9	54	107	*937*	*4,209*	*407*	*403*	16	10	0
District 1 Subtotal		**234**	**483**	**6,332**	**19,701**	**2,139**	**1,260**	**66**	**56**	**0**
Mountain Village	9/15-17	108	213	2,174	6,497	*873*	*745*	6	60	0
Pitkas Point	9/19	15	89	633	800	49	130	1	20	0
St. Marys	9/17-18	81	79	1,916	4,521	762	276	3	70	0
Pilot Station	9/20-21	53	108	*2,886*	*4,163*	*823*	*371*	3	52	0
Marshall	9/21-22	46	246	2,059	792	394	64	3	30	0
District 2 Subtotal		**303**	**735**	**9,668**	**16,773**	**2,901**	**1,586**	**16**	**232**	**0**
Russian Mission	9/21-22	42	170	*2,057*	*171*	615	178	1	24	0
Holy Cross	9/23-24	39	36	2,395	214	9	498	9	16	0
Shageluk	9/30	18	89	531	5,473	114	35	8	14	0
District 3 Subtotal		**99**	**295**	**4,983**	**5,858**	**738**	**711**	**18**	**54**	**0**
Lower Yukon River Total		**636**	**1,513**	**20,983**	**42,332**	**5,778**	**3,557**	**100**	**342**	**0**
Anvik	10/1-4	19	83	1,286	844	179	12	13	6	0
Grayling	9/25-26	37	48	1,613	1,072	441	559	1	18	0
Kaltag	10/13	47	73	1,838	1,028	*725*	*463*	0	28	0
Nulato	10/14-15	46	233	2,531	180	1,341	928	2	18	0
Koyukuk	10/16-17	16	70	860	1,339	835	1,155	4	18	0
Galena	10/18-19	78	421	3,112	289	1,510	1,507	11	20	3
Ruby	10/13	16	169	631	876	2,331	648	4	0	12
District 4 Yukon River Subtotal		**259**	**1,097**	**11,871**	**5,628**	**7,362**	**5,272**	**35**	**108**	**15**
Huslia	10/16-17	32	267	469	6,187	1,786	375	10	0	0
Hughes	10/14-15	6	50	113	1,265	497	20	6	0	0
Allakaket	10/20-21	21	180	306	4,383	105	99	8	0	0
Alatna	telephone	2	4	12	50	0	7	2	0	0
Bettles	10/20	0	118	0	0	0	0	0	0	0
Koyukuk River Subtotal		**61**	**619**	**900**	**11,885**	**2,388**	**501**	**26**	**0**	**0**
District 4 Subtotal		**320**	**1,716**	**12,771**	**17,513**	**9,750**	**5,773**	**61**	**108**	**15**
Tanana	10/27-28	38	225	5,332	3,075	*14,308*	3,480	10	0	27
Rampart	10/15	6	17	1,411	9	*365*	0	6	0	0
Fairbanks NSB e	permits	56	274	1,932	89	105	120	55	0	1
Stevens Village f	11/3-4, permits	13	87	1,121	0	857	0	11	0	0
Birch Creek	telephone	3	6	78	0	2	0	3	0	0
Beaver	10/30-31	10	10	1,156	7	192	0	7	0	3
Fort Yukon	10/6-9	71	426	4,004	2,176	7,961	244	12	0	51
Circle	permits	12	73	895	85	499	0	6	0	6
Central	permits	3	6	144	0	0	0	3	0	0
Eagle g	permits	37	271	2,081	104	2,871	0	29	0	8
Other h	permits/calendars	12	48	862	0	0	25	12	0	0
District 5 Yukon River Subtotal		**261**	**1,443**	**19,016**	**5,545**	**27,160**	**3,869**	**154**	**0**	**96**

-Continued-

Table 1. (Preliminary, page 2 of 2).

Community [a]	Survey Date or Permit Village	Number of Fishing Households [b]	Number of Dogs	Estimated Harvest				Primary Gear Used [c]		
				Chinook	Summer Chum	Fall Chum	Coho	Set Gillnet	Drift Gillnet	Fish Wheels
Venetie	10/10-11	7	61	121	0	752	10	5	0	0
Chalkyitsik	10/10-12	4	32	50	0	340	7	3	0	3
Chandalar and Black Rivers Subtotal		**11**	**93**	**171**	**0**	**1,092**	**17**	**8**	**0**	**3**
District 5 Subtotal		**272**	**1,536**	**19,187**	**5,545**	**28,252**	**3,886**	**162**	**0**	**99**
Manley	permits	6	220	213	65	1,303	886	3	0	3
Minto	permits	17	81	317	625	675	423	16	0	1
Nenana [j]	permits	22	295	1,215	2,246	7,840	5,431	13	0	9
Healy	permits	3	36	0	0	1,253	2,574	3	0	0
Fairbanks NSB [k]	permits	38	135	574	126	2,305	1,598	34	0	4
Other [m]	permits	19	94	30	0	4	0	18	0	0
District 6 Tanana River Subtotal		**105**	**861**	**2,349**	**3,062**	**13,380**	**10,912**	**87**	**0**	**17**
Upper Yukon River Total		**697**	**4,113**	**34,307**	**26,120**	**51,382**	**20,571**	**310**	**108**	**131**
Survey Village Subtotal		1,298	4,458	47,624	75,214	37,596	11,972	284	450	99
Subsistence Permit Subtotal [n]		193	1,533	8,059	3,192	16,461	10,508	110	0	25
Subsistence Test Fish Subtotal [p]		-	-	1,253	3,866	2,855	1,391	-	-	-
Subsistence Harvests Subtotal		**1,491**	**5,991**	**56,936**	**82,272**	**56,912**	**23,871**	**394**	**450**	**124**
Personal Use Permit Subtotals		**32**	**-**	**204**	**148**	**394**	**549**	**32**	**0**	**0**
Alaska, Yukon River Total [r]		**1,333**	**5,626**	**55,290**	**68,452**	**57,160**	**24,128**	**410**	**450**	**131**
Alaska, Yukon Area Total		**1,523**	**5,991**	**57,140**	**82,420**	**57,306**	**24,420**	**476**	**450**	**131**
AK, Yukon Area Percentages of the Total		**-**	**-**	**26%**	**37%**	**26%**	**11%**	**43%**	**40%**	**12%**

Italicized numbers indicate that test fish have been added to the total fish harvested in that village as reported in the post season survey.

[a] Data collected by Alaska Department of Fish and Game (ADF&G), Division of Commercial Fisheries. Survey data is expanded for number of fishing households, number of dogs, and harvest. Permit data is unexpanded, and is from all permits received as of April 30, 2004. The number of dogs is based on information obtained from permits issued, while the number of fishing households and their harvest is based on returned permits.

[b] Estimated number of households that fished in surveyed communities or number of permit households who reported fishing in permit required areas.

[c] Primary Fishing Gear is not expanded for households that were not surveyed.

[d] Formally known as Sheldon or Sheldons Point.

[e] Fairbanks North Star Borough (Fairbanks NSB) households that obtained a permit and indicated they fished in the Yukon River permit required area.

[f] Permit harvest information from Stevens Village residents was used to complement the information obtained by the survey.

[g] Does not include approximately 14,500 to 15,000 coho salmon obtained from Valdez Fisheries Development Association as part of the Enhance *Mainstem Salmon Escapement Project* (URE-12-03) funded by R&E Fund.

[h] Other includes residents of Coldfoot, Manley, Nenana, Minto, and the Upper Tanana River drainage villages of Northway and Tok who obtained a household permit and fished in a Yukon River permit required area.

[j] Does not include approximately 14,000 coho and chum salmon sold commercially for roe and carcass returned to fishermen for dog food in Subdistrict 6-B.

[k] Fairbanks North Star Borough (Fairbanks NSB) households that obtained a subsistence and/or personal use permit and indicated they fished in the Tanana River permit required area.

[m] Other includes residents of Eagle River, Denali Park, Anderson, and the Upper Tanana River drainage villages of Delta Junction, Tanacross, Tok, and Northway who fished in the Tanana River.

[n] Subsistence Permit Subtotal does not include Stevens Village

[p] Test fish given away for subsistence use.

[r] Does not include Coastal District.

The 2003 subsistence harvest estimates include test fish given away to local communities, but do not include a combined total of approximately 30,000 fish carcasses obtained from the commercial fall chum and coho salmon roe fisheries on the Tanana River and coho salmon obtained from the Valdez hatchery for the Eagle "replacement fishery". Although these fish were used for dog food and contribute to meeting the subsistence needs, the salmon were not included in harvest estimates to avoid double counting in the case of the Tanana River commercial harvested fish or not of Yukon River origin salmon in the case of the Valdez hatchery fish.

Evaluation: No significant problems were evident and this project's and goals will be met by the end of 2004 with the completion of the RIR *Subsistence and Personal Use Salmon Harvests in the Alaska Portion of the Yukon River Drainage, 2003.*

Since the project has become reasonably standardized, the information collected over the years is comparable and provides for an effective data source concerning a variety of issues. The Yukon Area fisheries are unique because they provide the highest subsistence salmon harvests per household in the state. In addition, the fisheries contain highly controversial commercial roe fisheries which provide a by–product utilized in the subsistence fishery. Issues that continue to raise concerns are the high utilization of chum salmon for dog food, feeding Chinook salmon to dogs, fish lost to *Ichthyophonus hoferi,* and most recently the customary and traditional selling of salmon and salmon parts for cash. The customary and traditional issues highlight the differences in state and federal regulations and approaches toward trade and bartering.

This harvest assessment program provides a tool to explore issues of importance that affect all user groups. The survey results are applied to issues brought before the BOF and the U.S./Canadian negotiations. In 1999, additional questions were added to the survey portion to address the BOF concerns about feeding Chinook salmon to dogs. In 2002, a question was added to ascertain the viability and document use of dip nets as an alternative gear type to harvest coho salmon during times of fall chum salmon harvest restrictions. Most recently, the 2003 survey addressed possible loss of fish due to spoilage, predation, and unpalatable fish attributed to *Ichthyophonus hoferi*, and whether or not these fish were accounted for when included in subsistence totals of surveyed households.

Tribal entities continue to show interest or have begun collecting their own salmon harvest information, although most lack the infrastructure or expertise to summarize the information in a useful format. This duplication of effort and questions of loyalties will become a problem in the future.

Additional work may be necessary to identify and contact households that take harvested salmon out of the Yukon Area (i.e., commercial and subsistence fishermen who reside outside the Yukon Area surveyed communities and remove Chinook salmon as home pack).

Conclusion: The Yukon Area includes all waters of Alaska within the Yukon River drainage and all coastal waters of Alaska from Point Romanof southward to the Naskonat Peninsula. Successful management of fishery resources is dependent upon obtaining accurate estimates of subsistence and personal use salmon harvests within the Yukon Area. These estimates provide

trend information by species in a dynamic and changing fishery. The estimates of salmon harvest are considered in BOF allocations as well as Canadian negotiations. In seasonal prosecution of fisheries, especially during poor returns, the estimates provide valuable insight into the level of harvest taken by species throughout the Alaskan portion of the Yukon River drainage.

VI. Products:

Products will include the annual Alaska Regional Information Report No. 3A04-XX (in preparation) titled *Subsistence and Personal Use Salmon Harvests in the Alaska Portion of the Yukon River Drainage* for 2003.

Dissemination of Project results: Individual households and all recent permit holders are annually provided a summary table of the salmon harvest estimates from the entire Yukon River drainage preseason. Various agencies are mailed copies of a completed report annually upon request. Report recipients include ADF&G (Division of Commercial Fisheries, Sport Fisheries, and Subsistence); U.S. Fish and Wildlife Service, including the Offices of Subsistence Management; National Park Service, Bureau of Land Management, and National Wildlife Refuge Managers. Tanana Chiefs Conference, Association of Village Council Presidents, Council of Athabascan Tribal Governments (Ft. Yukon and Stevens Village), Tribal Councils (Emmonak, Mt. Village, and Tanana), Alaska Outdoor Council, Yukon River Drainage Fisheries Association, Alaska Resources Library Information Services, Department of Labor and Work Force, Department of Fisheries and Oceans (Canada), and select fishermen.

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McIntosh, B. *In Press*. Estimation of Yukon River salmon passage in 2002 using hydroacoustic methodologies. Alaska Department of Fish and Game, Commercial Fisheries Division, Regional Information Report 3A03-XX, Anchorage.

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VIII. Key Words:

Board of Fisheries, Chinook, coho, fall chum, personal use, salmon, subsistence, summer chum, Tanana River, Yukon Area.

5. YUKON RIVER SALMON SPAWNING ESCAPEMENT SURVEYS

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NA03NMF4380185
Period Covered by the Report From: July 1, 2003 To: June 30, 2004
Date Prepared: December 2004

II. Executive Summary:

An essential requirement for management of the Yukon River salmon fisheries is the documentation of annual salmon spawning escapements. Comprehensive salmon spawning assessment projects employ such techniques as intense ground surveys, mark-recapture methods, counting towers, weirs, and hydroacoustics on tributaries that are important salmon producers. The Yukon River drainage is too extensive for comprehensive escapement coverage of all individual salmon spawning streams during any given season. Consequently, low-level aerial surveys from single-engine fixed-wing aircraft or helicopters form an integral component of the escapement assessment program. Aerial surveys provide limited, but important indices of spawning salmon escapements and when paired with age and sex information, spawning salmon populations can be described in detail. The information is used for determination of appropriate escapement levels, or goals, for selected spawning areas or management units; evaluation of escapement trends; evaluation of the effectiveness of the management program, which in turn forms the basis for proposing regulatory changes and management strategies; and evaluation of stock status for use in projecting subsequent returns.

III. Purpose of Project:

Documentation of salmon returning to spawn in tributaries of the Yukon River is an essential requirement for management of Yukon River fisheries. Documentation of spawning indices, among other information, provides data to determine appropriate escapement levels and evaluation of escapement trends. Without escapement information managers do not have a basis to document levels of returning salmon to spawn. Without knowledge of weak salmon species and stocks, other salmon species and stocks risk over-harvesting.

The objective of this project is to provide escapement level indices and escapement spawning estimates of salmon returning to tributaries of the Yukon River. Another goal is to use long-term escapement information and indices to establish escapement goals. These goals represent the approximate minimum number of spawners considered necessary to maintain historical yields. Age composition from escapement projects allows development of brood year tables the foundation for spawner-recruit analysis which intern provides information for projecting future returns.

IV. Approach:

Aerial surveys were conducted in areas where indexes have been established for a particular species of salmon. The data provided by this funding source includes aerial surveys conducted in the middle Yukon River drainage within Alaska including the Andreafsky, Anvik, Nulato, Gisasa,

Chena and Salcha Rivers for Chinook salmon; Andreafsky, Rodo, Nulato, Gisasa, Hogatza, Tozitna, Chena and Salcha Rivers for summer chum salmon; upper Tanana River continues to be monitored through aerial surveys for distribution of fall chum salmon spawning activities which congregate specifically in areas with upwelling ground water. The Tanana River is the most impacted by industrialization and development within the Alaskan portion of the Yukon River drainage particularly in the stretch between the communities of Nenana and Delta, which encompasses the Fairbanks area. In particular intense ground surveys are conducted annually in the Toklat and Delta Rivers where stream life data is used to estimate abundance of fall chum salmon spawners. A limiting factor of aerial surveys includes hindrance caused by inclement weather, high water, and fire season as well as stream morphology. Other areas are observed as time permits to get a feel for overall distribution outside of the index areas and may include identifying new areas where salmon are observed.

One Fishery Biologist I is budgeted to conduct apportion of both aerial and ground surveys particularly within the Tanana River drainage with assistance from Fish and Wildlife Technicians IIs in conducting ground surveys. Additionally, Fishery Biologist IIs and IIIs, whose salaries are covered under another source, conduct many of the surveys.

There are many escapement assessment projects throughout the Yukon River drainage as attempts are made to be as comprehensive as possible and have the ability to cover main spawning areas for Chinook, chum, and coho salmon assessment. Projects are operated by a substantial number of personnel from various agencies and organizations participated in the collection of salmon escapement and information. These agencies and organizations include the Alaska Department of Fish and Game (ADFG Divisions of CF and SF), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), Bureau of Land Management (BLM), National Marine Fisheries Service (NMFS), Alaska Cooperative Extension 4-H program, Bering Sea Fishermen's Association (BSFA), and Tanana Chiefs Conference (TCC).

IV. Results, Evaluation and Conclusions:

Chinook and Summer Chum Salmon

Chinook salmon are the most important species concerning value in both the commercial and subsistence fishery. They are very important to our negotiations with Canada since nearly 46% of the U.S. harvests of Chinook salmon originate from Canadian stocks. Chinook salmon aerial surveys are slightly easier to conduct since the salmon have a larger relative size and distinct red coloring, which assists in making them stand out and easier to count from the air. Aerial surveys for Chinook salmon were conducted for the middle Yukon River index areas during June and July with the results in table below:

Chinook Salmon	2002	2003	2004
East Fork Andreafsky River	1,447	Poor	2,879
West Fork Andreafsky River	977	1,578	1,317
Anvik River	1,713	Poor	3,681
Nulato River	1,584	No Survey	1,321
Koyukuk River			
Gisasa River	506	No Survey	731
South Fork Koyukuk	No Survey	No Survey	No Survey
Jim River	No Survey	No Survey	No Survey
Nenana River			
Chena River	No Survey	No Survey	No Survey
Salcha River	2,256	No Survey	No Survey

Summer chum salmon are much more difficult to see from the air due to smaller size and coloration however if conditions are right attempts are made to enumerate them along with the Chinook salmon counts. Also the peak timing of spawning can be slightly different between the two species so the chum salmon surveys would be considered minimums unless they were strictly done to target that species.

Fall Chum and Coho Salmon

Intensive ground surveys are conducted for fall chum salmon within the Tanana River drainage. The Delta River is walked once a week from the first week in October until early December. The replicate survey counts are used to develop a total spawning escapement for the system. The Toklat Springs fall chum salmon spawning population is estimated using stream life and relative timing and the relationship to the one time annual survey conducted at this site. Timing of the survey is nearest to the peak of spawning (mid October) but yet close enough to freeze up to allow for the water level to drop in order to increase visibility. Age, sex, and length data is collected annually at both of these locations. Additionally, several surveys are conducted at the Bluff Cabin Slough area around the peak of spawning and aerial surveys are often used to indicate when the ground survey should be attempted. Only the peak survey is shown in the table below. Other areas of the drainage upstream of Fairbanks are surveyed by airplane or helicopter at remote locations as they are being monitored for changes in spawning distribution and affects of industrialization, particularly in the upper Tanana River drainage where mining, forestry, and civilization encroaches on salmon spawning habitat.

Fall Chum Salmon	2001	2002	2003
Delta River	8,103	11,992	22,582
Toklat River	6,007	28,519	21,492
Bluff Cabin Slough	1,808	3,116	10,600
Other Delta Areas	3,183	3,617	24,993

The Delta and Toklat Rivers both have historical population estimates based on data from either aerial or ground surveys dating back to 1974. Additionally both of these systems have Biological

Escapement Goals that have been modified over the years as more data became available. The latest revision made in 2000 included changing the single goal to ranges that encompassed maximum sustained yield. The analysis of the Delta River resulted in a range is 6,000 to 13,000 fall chum salmon while the Toklat River range is 15,000 to 33,000 fall chum salmon. These two areas are critical pieces in the run reconstruction within the Tanana River drainage and are utilized as an index for the system however a significant portion of the Tanana River stocks may spawn in the mainstem as indicated by the upper Tanana and Kantishna River mark-recapture projects. Bluff Cabin Slough has historical counts either aerial or ground dating back to 1972. The ground surveys in these locations should be continued as they are being compared using regression analysis to the mark-recapture estimates to establish the relationship between the indexes and the Tanana River drainage as a whole. Remote sloughs along the mainstem upper Tanana River are monitored via aerial surveys.

Survey conditions during the fall chum and coho salmon season from late-September through November 2003 varied by location and ranged from poor to good in the Alaskan portion of the drainage. High water persisted in the Tanana and Kantishna Rivers late into the fall due to unseasonably warm temperatures including new records set on September 30 and October 1-2, 2003 of $\geq$70 °F. Good aerial and foot survey conditions were encountered on selected fall chum and coho salmon spawning areas in the Nenana River drainage. Surveys conducted in the upper Tanana River south bank ranged from good visibility to poor with poor being associated with high/deep murky sections and increased amounts of ice coverage. The high water caused by warm temperatures affected aerial surveying of the upper Tanana River mainstem resulting in counts after peak spawning in some areas. High water in the Delta and Toklat Rivers also affected foot surveying and more than likely resulted in conservative estimates for these areas. Age-sex-length data (vertebra) are also collected from fall chum salmon carcasses in both the Delta and Toklat Rivers and analysis includes samples taken from the Sheenjek River.

Because of the comprehensive coverage of fall chum salmon spawning areas and the current level of monitoring projects, a total run reconstruction can be attained for fall chum salmon. The estimates in 2003 were much improved from previous years, especially since 2000, which was the worst drainagewide return on record for fall chum salmon. All of the fall chum salmon goals within the drainage were met or exceeded except those on the Porcupine River (Sheenjek and Fishing Branch Rivers). Factors in the marine environment were thought to be depressing Yukon River drainage chum salmon stocks since there were adequate parent year escapements and the entire Western Alaskan Region chum salmon stocks were similarly affected. Returns from the poor escapement years appear to be recovering and indicate improved productivity. The returns have risen steadily in all monitored areas with exception of the Porcupine River drainage and indications are that the 2004 return is expected to be significantly better.

Coho salmon are typically surveyed as a secondary species during fall chum salmon aerial and ground surveys. Due to freeze up and timing, surveys can only be conducted mid to early November. The data presented here only includes those conducted using this funding source.

Coho Salmon	2001	2002	2003
Geiger Creek (Toklat Survey)	578	744	973
Richardson Clearwater River	1,531	874	6,232

Other funding sources have been utilized to count coho salmon within the Tanana River drainage including areas in the Nenana and Delta Clearwater Rivers (DCR). The DCR stock has an escapement objective of 9,000 coho salmon. A record of 103,000 coho salmon was counted in the 2003 DCR escapement. However, indications from inseason monitoring projects, lack of harvests taken as part of protection of fall chum salmon, reduced harvests in marine waters, in combination with improved marine food supply, indicate the coho salmon populations appear to be generally increasing in the region.

In terms of the overall project success, most of the goals and objectives are met on an annual basis concerning ground based counting projects. More ground-based escapements are needed to produce quality escapement information. Variability in aerial survey accuracy is dependent upon a number of factors such as weather, water conditions (turbidity), timing of the surveys with respect to peak spawning, type of aircraft used and availability of aircraft, experience of the pilot and surveyor, and the type and density of the salmon species being estimated. Further, peak-spawning abundance measured by aerial survey is significantly lower than total season abundance due to die-off of early spawners and subsequent later arrival of fish. Given these sources of variability, aerial survey estimates demonstrate a wide range in the proportion of the fish being estimated. Another concern is, of all the methods of determining abundance of fish, aerial surveys are the most dangerous due to the nature of flying slow at low altitudes. Successful aerial surveys are highly dependent on good weather and water clarity.

V. Products

Project results have been reported in the following Regional Information Reports (RIR):

Bergstrom D.J., K.R. Boeck, B.M. Borba, A.L.J. Brase, F. Bue, W.H. Busher, J.S. Hayes, T.L. Lingnau, P. Salomone, and T. Vania. (In Prep), Annual Management Report, Yukon Area, 2003, Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region, 333 Raspberry Road, Anchorage, Alaska 99518-5526.

Joint Technical Committee of the Yukon River US/Canada Panel. 2004. Regional Information Report No. 3A04-09. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region, 333 Raspberry Road, Anchorage, Alaska 99518-5526.

These reports were distributed to personnel with the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service and Canada Department of Fisheries and Oceans. Results have also been reported to the U.S./Canada Joint Technical Committees and Yukon River delegate members as well as fishermen's groups through postseason and preseason fisheries meetings as well as State Advisory Committee and Federal Regional Advisory Committee meetings.

VI. References:

Same as listed in Products.

VII. Key Words:

Yukon River, Chinook salmon, chum salmon, coho salmon, aerial survey

6. Lower Yukon River Sonar at Pilot Station

Bruce McIntosh
NA03NMF4380185
Period Covered by the Report From: July1, 2003 To: June 30, 2004
Date Prepared: December 2004

II Executive Summary:

Salmon are harvested for commercial and subsistence purposes throughout the Yukon River drainage in Alaska and Canada. These salmon fisheries are critical to the river's people and economy, providing an important source of food and income. The lower Yukon River sonar project at Pilot Station is designed to provide accurate and timely salmon passage estimates to fishery managers. Deployed at river km 197, near the village of Pilot Station, the project is located far enough upriver to avoid the wide multiple channels of the Yukon River Delta yet far enough downstream to assess the majority of salmon stocks. The Andreafsky River is the only major salmon spawning tributary downstream of the sonar site. This project was first operational in 1986 and has since provided daily salmon passage estimates each year, with the exceptions of 1992 and 1996. Passage estimates are generated using shore-based, split-beam sonar for enumeration and drift gillnets for species apportionment.

Sonar counting was conducted during three 3-h sampling periods each calendar day. The passage rates were expanded to generate a passage estimate for the entire 24-h period. On five occasions during the season the sonar was operated continuously for 24 h, with these estimates compared to the count generated using the normal three 3-h sampling periods for that day. On average, the expanded 9-h estimates exceeded the 24-h counts by 13%.

Species apportionment data was generated during two 3-h drift gillnet periods each day, interspaced between the sonar sampling periods. A suite of gillnets, 25 fathoms (45.7 m) in length with mesh sizes ranging from 2.75 inches to 8.5 inches (70 mm to 216 mm) stretch mesh, were drifted through the ensonified areas of the river. Species proportions were estimated from catch per unit effort information and the differing probabilities of capture for each species and length in each mesh size. Adjusted catches were used to apportion sonar passage estimates by species in three zones - near shore on both banks and offshore on the left (south) bank. During the 2003 season an estimated 258,000 Chinook salmon, 1,235,000 summer chum salmon, 930,000 fall chum salmon, 5,600 pink salmon, and 277,000 coho salmon passed the sonar site.

III. Purpose of Project:

Salmon are harvested for commercial and subsistence purposes throughout the Yukon River drainage in Alaska and Canada. Due to the broad geographic distribution of the Yukon River's various salmon stocks, management of the fisheries is complex, creating a need for accurate and timely in-season estimates of salmon passage.

The Yukon River sonar project at Pilot Station is intended to provide accurate and timely salmon passage estimates on a daily basis to fishery managers. The project design incorporates fish passage estimates from shore-based, split-beam sonar data and species composition estimates from drift gillnet data obtained by fishing a suite of gillnets. Located at river km 197, near the

village of Pilot Station, the project is far enough upriver to avoid the wide multiple channels of the Yukon River Delta, yet far enough downstream to assess the majority of salmon stocks, providing timely information for the in season management of commercial and subsistence fisheries. The Andreafsky River is the only major salmon spawning tributary downstream of the sonar site.

This project has produced estimates of daily fish passage since 1986, except during 1992 when it was operated for experimental purposes and 1996 when it was operated for training purposes. Since 1993, the project has used hydroacoustic equipment that operates at a lower frequency (120 kHz) than previously (420 kHz), and is capable of detecting fish at significantly longer ranges. During the 2001 season the project transitioned from an older dual-beam system to the current split-beam equipment, which provides more accurate target information. Passage estimates are only comparable between years after 1994 because of changes in frequency and aiming criteria initiated in 1995.

Project objectives during this operational period were to provide fishery managers with daily and cumulative passage estimates, along with associated confidence intervals, for Chinook salmon, summer and fall chum salmon, pink salmon and coho salmon. Secondary objectives included refining sonar methodology, collecting scale samples for age-length-sex analyses and assisting in the collection of tissue samples for genetic analyses.

IV. Approach:

Salmon passage estimates at Pilot Station are generated from a sampling design in which acoustic data are collected on each bank for 9 h daily during three 3-h periods. Two gillnet sampling periods are conducted between the acoustic sampling periods. Sonar sampling periods are scheduled to begin at 0530, 1330 and 2130 hours. Testfishing periods occur at 0900 and 1700 hours.

Bottom Mapping

Bathymetric maps of the river bottom, in the vicinity of the sonar site, were generated throughout the season in 2003 using a depth sounder coupled to a differential global positioning system (DGPS). Placement and aiming of the transducers was optimized based on the generated profiles. Maps created during past field seasons allowed for inter-annual monitoring of changes in the bottom topography, which could affect fish migratory behavior and subsequent detection.

Sonar Deployment

In 2003, a single sonar transducer was deployed on both the left (south) bank and on the right (north) bank, at a point where the river is approximately 1,000 m wide. These deployment locations were nearly identical to previous years. The right bank has a stable, rocky bottom that drops off steeply to the thalweg with a vertical angle of 8.7°, calculated from a depth of 22.9 m at a range of 150 m. The right-bank transducer was positioned approximately 5 m from shore, adjusting the aim for each of two strata (0-40 m and 40-140 m) to position the beam as close to the river bottom as possible for each sample.

The left-bank river bottom drops off gradually with a vertical angle of 2.3°, calculated from a depth of 11.9 m at 300 m, with a slightly steeper slope near shore (4.2° calculated from a depth

of 3.7 m at 50 m). A single transducer was deployed approximately 10 m offshore and utilized three aims to sample a near shore stratum (0-50 m), a midshore stratum (50-150 m), and an offshore stratum (150-250 m). The transducer was repositioned as required to compensate for changing water levels.

Although in 2001 and 2002 the project transitioned from a dual-beam system to split-beam equipment, the operational frequency (120 kHz) and deployment of the new sonar were kept consistent with previous years. The nominal beam widths for the transducers were similar to the previously operated dual-beam equipment. For the right bank we utilized a transducer with a 6°x10° nominal beam width and for the left bank we utilized transducers with 2.8°x10° and 4.0°x10° nominal beam widths.

Testfishing

Drift gillnetting was conducted to apportion the sonar fish counts to species. Mesh sizes ranged from 2.75" to 8.5" to ensure all fish species detected by the sonar are represented, resulting in an estimate of daily proportions by species. All captured fish were measured for length, the sex of each salmon was determined, and scales for age analysis were collected from each Chinook salmon. Tissue samples for genetic analysis were collected from both chum and Chinook salmon. The majority of captured fish were retained and distributed to local residents for subsistence use. The net selectivity curves that are used in species apportionment were reviewed and subsequently modified during this time.

ADF&G staff conducted project planning, execution and oversight. Work was accomplished by ADF&G staff in cooperation with technicians provided by The Association of Village Council Presidents (AVCP) and the Yukon River Drainage Fisheries Association (YRDFA).

V. Results, Evaluation and Conclusions:

As in previous years the rock substrate on the right bank provided a stable, workable bottom while the silt substrate on the left bank resulted in a moving bottom, requiring constant monitoring and adjustment of transducer aim and placement. Over time the river profile itself has changed. We are noticing significant erosion of the south bank that, although it currently does not pose a problem, has the potential to affect deployment if it continues to degrade. Bottom topography will continue to be an important component of the project and will be closely monitored in future years.

Passage Estimates

In 2003, the Yukon River sonar project was operational from 5 June to 31 August. Throughout the season, passage estimates were reported daily to fishery managers in Emmonak and Fairbanks. These estimates included Chinook salmon, summer and fall chum salmon, coho salmon and other fish. Other fish included pink salmon, whitefish, sheefish, burbot, sucker, Dolly Varden, sockeye salmon, and northern pike. It was not the intent of this project to document complete coho or pink salmon runs.

During this time an estimated 3,104,768 fish passed the sonar site. The cumulative estimated passage for each targeted salmon species was: 235,161 large Chinook, 22,475 small Chinook,

1,235,023 summer chum, and 930,452 fall chum. Additionally, passage estimates for non-target targeted fish species include 277,504 coho salmon and 398,557 other fish species

24-Hour Sonar Periods
In 2003 we sampled continuously for 24 h on 22 June, 06 and 21 July, and on 05 and 18 August, for a total of five 24-h sampling periods. On average the three 3-h periods overestimated passage by 13% relative to the 24-h periods. Uncertainties in fish behavior during the 24-h sonar periods, induced by drift gillnetting while simultaneously counting with the sonar, may account for some of the variability of these data.

Testfishing
In 2003, 9,413 fish were captured during 2,091 drifts including 897 Chinook salmon, 3,521 summer chum salmon, 2,426 fall chum salmon, 1,436 coho salmon, and 1,133 fish of other species. There were 4,914 fish retained and distributed for subsistence use, including 846 Chinook, 2,883 summer and fall chum, 371 coho, and 536 whitefish.

VI. Products:

Project objectives of providing daily and cumulative passage estimates for Chinook and chum salmon were met in 2003. In addition, the project collected all requested biological samples for age and stock analyses. Species apportionment methodology continued to be refined and net selectivity estimated more accurately. Electronic data was collected to explore the feasibility of using computer software to estimate fish numbers.

Project results are disseminated through Regional Informational Reports (McIntosh in prep, Pfisterer 2002, Rich 2001) and this report:

VII. References:

McIntosh B.C. Yukon River Sonar Project Report 2003. In prep.

Pfisterer, C.T. 2002. Estimation of Yukon River Salmon Passage in 2001 Using Hydroacoustic Methodologies. Regional Information Report No. 3A02-24. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Rich, C.F. 2001. Yukon River Sonar Project Report 2000. Regional Information Report No. 3A01-13. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

7. YUKON PROGRAM SUPPORT

Alaska Department of Fish and Game, Division of Commercial Fisheries and National Marine Fisheries Service
Steve Hayes
NA06FP0075
Period Covered by the Report From: July1, 2003 To: June 30, 2004
Date Prepared: December 2004

II. Executive Summary

Test fishing in the lower Yukon River was initiated in 1963 at Flat Island. Set nets were fished 7 days per week, 24 hours per day through the Chinook and summer chum salmon runs (late May to mid-July). In 1977, test fishing was expanded to include the fall chum and coho salmon runs (mid-July to the first of September) in the Big Eddy area near Emmonak. Test fishing at Flat Island was discontinued in 1979 and test fishing in the south mouth (Kwikluak Pass) was conducted throughout the season in the Big Eddy area. Test fishing was initiated in the Middle Mouth area (Kawanak Pass) in 1979. During 1980 and 1981 the Middle Mouth project was extended in duration to cover the fall chum and coho salmon season, and geographically to cover the north mouth (Apoon Pass) of the delta.

The Lower Yukon Set Gillnet Testing project operates from end of May through July 15, each season. This project provides important information concerning the pattern of entry of the Chinook and summer chum salmon into the Yukon River mouths. This project provides approximately 2,000 Chinook and approximately 6,000 summer chum salmon annually for subsistence use in the local communities of Emmonak and Kotlik. Additionally, salmon harvested from the operation of the test fish program may be sold in years commercial fisheries were conducted in the area.

III. Purpose of Project

The State of Alaska is mandated to provide adequate escapement of salmon to the spawning grounds as well as provide harvests in the Alaskan subsistence, sport, personal use, and commercial fisheries. Additionally, the United States and Canada have maintained goals established in the previous interim agreement for the purpose of seeking to ensure the effective conservation and management of Yukon River salmon and to provide for Canadian origin Chinook salmon escapement and harvests. The information gathered from the assessment project is used inseason during prosecution of Alaskan commercial and subsistence fisheries.

The vast size of the drainage (330,000 square miles) makes it impossible to assess individual tributaries escapements. Other escapement estimates based on aerial surveys of index tributaries are not conducted for weeks and in some cases months after key management decisions have to be made in the lower river fishery. As a result, management decisions are currently based on commercial catch and test fishing data collected during the season in the lower river.

However, due to the increase in the efficiency of the commercial fishing fleet in recent years and the corresponding decrease in fishing time, commercial CPUE is of limited usefulness as a comparative statistic. As a result it has become increasingly necessary to place greater reliance on

relative abundance information gathered form test fishing and/or Pilot Station Sonar for inseason management.

IV. Approach

From July 1, 2003 through July 1, 2004, test fishing has been conducted from the Big Eddy and Middle Mouth camps located in District 1. The Big Eddy test fish project was conducted from the village of Emmonak. Two technicians fished set gillnets to monitor salmon passage through the south mouth of the delta. The Middle Mouth camp was located at the junction of the main Middle and North mouth passes. Two technicians fished set gillnets to monitor salmon passage through the Middle Mouth and north mouth of the delta.

Test fishing begins as soon after ice breakup as possible, usually late May or early June. Productive set net sites, leased from local commercial fishermen, were fished 24 hours per day, seven days per week throughout the duration of the projects. The contracted commercial fishermen typically operated the test nets during commercial fishing periods and either sold or retained the fish for their own use. The rest of the time Department personnel fished the nets. Gillnets were picked at least twice each day (just before 8:00 a.m. and 8:00 p.m.). When large catches occurred some nets were picked more often. Fish found in the test nets alive and in good condition were counted and released by the technicians. Dead fish were given away to subsistence users. Daily test net catch and effort data gathered at the Middle Mouth camp was transmitted by radio and Satellite telephone to the Fish and Game office in Emmonak.

Two set gillnet sites were fished at Big Eddy prior to July 16. Two 8.5 in mesh nets (stretch measure) were targeted on Chinook salmon. The Middle Mouth camp operated two 8.5-inch mesh nets during the Chinook salmon season. All nets were 25 fathoms in length. The 8.5-inch mesh gillnets were 28 meshes deep.

Typically, catch data for missed fishing time was linearly interpolated from preceding and following data by fishing site.

An attempt is made each year to maintain standardized set net site locations while maximizing the coverage of the passes and the productivity of each net. This becomes a difficult task when water levels, eddies and sand bar locations change between and within seasons. In order to quantify some of these factors, a bottom profile is made at each net site with a Fathometer.

In addition, scale samples are taken from each fish sampled and scale data used to estimate the age composition at each location. Throughout the season, daily catches of freshwater fishes and salmon species not taken commercially were tallied at both projects. Climatological observations of cloud cover, precipitation, wind, and air and water temperatures were collected on a daily basis.

V. Results, Evaluation and Conclusions

A. The information collected during the operation of the Lower Yukon River test fishery is utilized inseason as well as documented in the Yukon Area Summer Season Data Notebook. Test fishing in the various mouths assists in the decision making process when commercial fisheries

are considered. The pulses of Chinook and summer chum salmon that enter the mouths can be tracked upriver through other strategically located projects and verified. Typically four to five pulses of Chinook and summer chum salmon enter the Yukon River drainage as detected by the Lower Yukon Set Gillnet Test Fishery. Over time the set gillnet sites have changed and the sites appear to becoming overly efficient when compared to other projects.

B. No significant problems to discuss. Set net sites appear to be changing to the extent that comparing years is becoming difficult. However, this method is still the best indicator available for assessing the run below the majority of the commercial or subsistence fishing districts within the Yukon River drainage by using the timing of pulses and mouth of entrance.

C. The goals of this project have been met. The long-standing historical database provides a starting point on which to begin to make assessments of salmon returns to the Yukon Area. Most of the commercial harvests are taken in the Lower Yukon Area however subsistence harvests are substantial and obligations to spawning escapement including the U.S./Canada border passage remain a priority. This supporting program provides a tool used in fisheries management for the benefit of all users.

VI. Products

Dissemination of Project results: Various agencies are regularly e-mailed and faxed inseason project information along with written or oral interpretations of projects. The inseason information is disseminated by ADF&G Division of Commercial Fisheries to other department divisions (i.e. sport fisheries and subsistence), United States Fish and Wildlife Service, Tanana Chiefs Conference, Association of Village Council Presidents, Council of Athabascan Tribal Governments, Tribal Councils and city offices in Yukon Area communities, Alaska Outdoor Council, Yukon River Drainage Fisheries Association, Alaska Resources Library Information Services, Department of Fisheries and Oceans (Canada). These summaries are available to select fishermen in many areas throughout the Yukon River drainage through their tribal or city offices and inseason information is available upon request. Yukon Area annual management reports contain the finalized project information and are free to agencies and public.

8. SHEENJEK RIVER SONAR

Roger Dunbar, Alaska Department of Fish and Game, Division of Commercial Fisheries
NA06FP0075
Period Covered by the Report From: July1, 2003 To: June 30, 2004
Date Prepared: December 2004

II. Executive Summary

The Sheenjek River is one of the primary producers of fall chum salmon in the Yukon River drainage. Fall chum salmon are harvested for both commercial, sport and subsistence purposes. This salmon fishery is important to the people and economy of this region, providing an important source of food and income. Sheenjek River sonar project provides accurate and timely chum salmon passage estimates to fishery managers.

The sonar project was initiated in 1980 and has operated every year since approximately 10 km upstream from the mouth of the river (Dunbar 2002). The project utilized fixed location, single-beam, side-looking sonar to estimate chum salmon passage through 2002. Because the original sonar equipment is no longer manufactured or supported, the Department purchased split-beam sonar as a replacement. In 2002, this equipment was operated side-by-side with the single-beam system in preparation for replacement in 2003. In 2003 the new sonar equipment was used exclusively to estimate chum salmon passage.

As in recent years, the Sheenjek River sonar project operated continuously 24-hours per day from one bank. Counts during periods of missed time (caused by such events as moving the transducer to avoid fluctuating water levels) were expanded and the numbers reported here reflect all expansions. The chum salmon escapement estimate for the Sheenjek River in 2003 was 44,047.

Due to inadequate conditions for transducer placement on the left bank, only the right bank of the Sheenjek River has been used to estimate fish passage. In an effort to estimate fish passage on the left bank, a new dual frequency, multi-beam sonar was deployed on the left bank from September 2, 2003 through September 10, 2003. This dual frequency identification sonar (DIDSON) allows placement in areas that were not possible with other systems. DIDSON results showed that 33% of the Sheenjek River chum salmon run passed the sonar site on the left bank over the period of this study.

III. Purpose of Project

Fall chum salmon are in great demand for commercial and subsistence uses. Commercial harvest is permitted along the entire mainstem river in Alaska as well as in the lower portion of the Tanana River. No commercial harvest is permitted in any other tributaries of the drainage including the Koyukuk and Porcupine River systems. Although commercial harvest also occurs in the Canadian portion of the Yukon River near Dawson, the majority of fish taken commercially occurs in the lower river, downstream of the village of Anvik. Fall chum salmon use as a subsistence item is greatest throughout the upper river drainage, upstream of the village of Koyukuk.

The Sheenjek River is one of the most important producers of fall chum salmon in the Yukon River. Located above the Arctic Circle, it heads in the glacial ice fields of the Romanzof

Mountains, a northern extension of the Brooks Range, and flows southward approximately 400 km to its terminus on the Porcupine River. The importance of this river as a producer of fall chum necessitated a project to monitor escapement and the establishment of escapement goals for fall chum salmon to the system.

The primary objectives of the Sheenjek River sonar project are to estimate fall chum salmon passage using hydroacoustic techniques, as well as collecting biological information using seined samples. The enumeration information is provided to managers in a timely manner so as to be used in prosecuting fisheries on the Alaskan portion of the Yukon River drainage. The biological data is analyzed postseason for documenting characteristics of the fall chum salmon escapement.

IV. Approach

In 2003, fall chum salmon estimates were obtained using a Hydroacoustic Technology Incorporated (HTI) Model 241 sonar system, with a fixed-location, 2°x10° elliptical split-beam transducer. A detailed bottom profile was obtained after initial transducer placement at the counting location by stretching a rope across the river and measuring water depth with a pole every 3m. As in previous years, a fish lead was constructed shoreward from the transducer to prevent upstream salmon passage inshore of the transducer. The lead was constructed to include the nearfield "dead range" of the sonar transducer.

The sonar operated 24-hours per day continuously on the right bank only. Counts during periods of missed time (due to such events as moving the transducer due to fluctuating water levels) were expanded and the numbers reported reflect all expansions. The 24-hour sonar estimates were relayed to the fishery managers daily.

The DIDSON is a new dual frequency, multi-beam sonar developed by the University of Washington, Applied Physics Laboratory. This sonar allows transducer placement in areas that were not possible with other systems, such as areas with large rocks, submerged vegetation or uneven bottom. The DIDSON was deployed on the left cut-bank using the same type of mount as the HTI sonar. DIDSON produces images that are near video quality, allowing the system operator to distinguish upstream fish from downstream fish and debris. The system operator visually counted the fish with a tally meter while watching the fish images on a computer monitor.

V. Results, Evaluation and Conclusions

In 2003, the project was operational from August 9 through September 26. The sonar-estimated escapement was 44,047 chum salmon. Based on historical data, the timing of the 2003 chum salmon run was about 10 days late. The median day of passage was observed on September 18. A diel migration pattern was observed, with a majority of the chum salmon passing the sonar site during periods of darkness or suppressed light.

Based on vertebrae collections, age-4 and age-5 chum salmon comprised 98% of the fish sampled. Age-5 fish dominated at 82% while age-4 fish represented 16%. Age 3 and age-4 fish each represented about 1% of the chum salmon passage. Male chum salmon comprised 54% of

the sample while 46% were female. Only 90 vertebrae samples were collected in 2003 due to the distribution and availability of the salmon for sampling, and difficulties operating the seine.

DIDSON was operated on the left bank of the Sheenjek River directly across from the right bank sonar site from September 2 through September 10. DIDSON results show that 33% of the Sheenjek River chum salmon run may pass the sonar site on the left bank.

VI. Products

During the reporting period, the project report for the 2002 field season was completed (Dunbar 2004) and the report for the 2003 field season initiated. Project results are disseminated through the following Regional Information Reports and this report:

Dunbar, R. 2004. Sonar Estimation of Fall Chum Salmon Abundance in the Sheenjek River, 2002. Regional Information Report No. 3A04-10. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

Dunbar, R. Sheenjek River Sonar Project Report, 2003. In prep.

VII. References

Dunbar, R. 2002. Sonar Estimation of Fall Chum Salmon Abundance in the Sheenjek River, 2001. Regional Information Report No. 3A02-27. Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage.

VIII. Key Words:

Chum salmon, *Oncorhynchus keta*, sonar, hydroacoustics, escapement, enumeration, Yukon River, Porcupine River, Sheenjek River

9. YUKON RIVER CHINOOK SALMON RADIO TELEMETRY PROJECT

Alaska Department of Fish and Game, Division of Commercial Fisheries and National Marine Fisheries Service
Ted Spencer and John Eiler
NA03NMF4380185
From: July 1, 2003 To: June 30, 2004
October 21, 2004

I. Executive Summary The Yukon River Chinook salmon radio telemetry program was initiated in 2000 by the Alaska Department of Fish and Game and the National Marine Fisheries Service. Work in 2000-2001 focused on feasibility and logistical components of the program in preparation for large-scale tagging studies in subsequent years. Results from this phase of the project indicated that basinwide tagging studies were feasible; large numbers of Chinook salmon could be captured and their upriver movement tracked. A basinwide tagging and monitoring program was conducted in 2002, 2003 and 2004, which provided information on distribution, movement patterns, the location of important spawning areas, and run abundance estimates.

II. Purpose of Project Poor returns of Yukon River Chinook salmon in recent years have raised serious concerns about future returns and reduced confidence in projecting run abundance. Fisheries within the basin are managed to ensure spawning escapements, provide for a subsistence harvests in the U. S., and ensure escapements of upper river stocks into Canada. The current management strategy relies heavily on the historic sustainability of Chinook salmon stocks within a relatively stable range of harvests. Management of Yukon River Chinook salmon is difficult because of the mixed stock nature of the run, broad distribution of spawning stocks, and relatively compressed run timing. Available run assessment techniques, including sonar apportionment sampling, test fishing projects, age structure and escapement projects have inherent technical limitations that must be recognized when evaluating Chinook salmon abundance. Managers using radio telemetry to track fish as they migrate upstream can follow the progression of the migration, determine the extent of their range, and estimate the proportion of the run returning to each monitored tributary. The specific objectives of this project were to: 1) estimate the abundance of Chinook salmon in major Yukon River tributaries and the entire Yukon River basin upriver of Russian Mission with relative precision, i.e., coefficient of variation less than 20%, 2) estimate stock specific run timing, migration rates, and movement patterns, and 3) estimate stock composition (proportional distribution) of the total Yukon River Chinook salmon escapement among major tributaries

III. Approach Estimates of total abundance for returning Chinook salmon in the Yukon River (upstream of Russian Mission) were obtained using mark-recapture techniques. In 2004 Chinook salmon were captured in the lower river with drift gill nets near the village of Russian Mission. The fish received a primary (spaghetti tag) and secondary (fin clip) mark, and were tagged with radio transmitters placed in the stomach. Biological data, including age, length, and genetics sample, were also collected. Marked fish were recovered in upriver fisheries and at tributary recovery projects.

Radio-tagged fish migrating upriver were recorded by remote tracking stations located at 38 sites along important migratory routes and spawning tributaries. Information recorded by the stations was used to calculate migration rates and document movement patterns for the different stocks tagged during the run. Data from remote tracking stations, paired with nearby tributary escapement data (towers, weirs, etc.), provided mark to unmarked ratios for population estimation. Aerial tracking surveys were flown to determine the status of radio-tagged fish in non-terminal reaches of the basin, and obtain detailed movement and distribution information in spawning tributaries.

Support for the project was provided by a number of agencies and organizations including the U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Land Management (BLM), National Park Service (NPS), Department of Fisheries and Oceans Canada (DFO), Bering Sea Fishermen's Association (BSFA), Yukon River Drainage Fisheries Association (YRDFA), and groups funded through the Yukon River Treaty Restoration and Enhancement (R&E) Fund. These organizations work together to develop a coordinated approach to fisheries research in the basin. Since the initial phases of the study, BSFA provided support for a tag recovery program at four upriver villages, two technicians for capture and tagging and the purchase of additional radio tags. YRDFA also provided a technician for capture and tagging and the purchase of additional radio tags. The USFWS and NPS provided funding for aerial surveys. BLM provided funding for completion of the remote tracking system. DFO and groups supported through the Yukon River Treaty R&E Fund installed and maintained additional tracking stations and conducted aerial surveys in Canada. The project also contracted with local residents to fish for Chinook salmon and assist with the tagging phase of the project. Canadian First Nations were active participants in the Canadian portion of the study. Use of local knowledge and assistance by project leaders, and the infusion of money into the local economies (for housing, food and supplies, equipment storage, etc.) have helped to develop a long-term relationship with the community of Russian Mission. U.S. members of the Yukon River Panel have suggested developing educational curriculum for local schools involving radio telemetry and mark recapture techniques. This project has received verbal support from the Association of Village Council Presidents, Village of Russian Mission, Village of Marshall, and Tanana Chiefs Conference, and letters of support from the Yukon River Panel, Council of Athabascan Tribal Governments, YRDFA, USFWS Subsistence Fishery Management, and ADF&G management staff.

IV. <u>Results, Evaluation and Conclusions</u> Results from work in 2000 and 2001 demonstrated that full-scale radio telemetry studies were feasible. Adequate numbers of fish were captured with drift gill nets in the lower river. Capture and handling methods did not appear to influence the behavior of the fish (Eiler and Holder, in press). Improved transmitters and receiving equipment made it possible to monitor fish movements in the lower river where Chinook salmon reportedly swim deep. In addition, the mark-recapture population estimation met the desired target precision (Spencer et al 2002).

The basinwide telemetry study conducted in 2002 was successful. Although the goal of 1000 Chinook salmon was not attained, 768 fish were radio tagged and tracked upriver, which provide an adequate sample for data analysis. Chinook salmon responded well to the capture and tagging procedures. A total of 748 (97.4%) fish resumed upriver movements after release; 258 (34.5%) of

these fish were subsequently caught in fisheries. A total of 535 fish, including those recovered in terminal fisheries, were tracked to areas throughout the basin, providing information on run distribution, migration patterns, and the location of important spawning areas. An automated database-GIS mapping program was used in-season to summarize telemetry data. Fishery managers, comparing telemetry data with information from fish wheel assessment projects at Rampart Rapids, the lower Tanana River and Nenana, were able to better assess the movement patterns and relative abundance of Chinook returns to the upper Yukon and Tanana Rivers, and take needed management actions

The basinwide telemetry study in 2003 was successful. A total of 1097 fish were radio tagged in the lower Yukon River near the village of Russian Mission. Most (1081, 98.5%) fish resumed upriver movements and were tracked upriver using remote tracking stations and aerial surveys; 271 fish were harvested in fisheries and 810 fish were tracked to upriver areas. An automated database-GIS mapping program was used in-season to summarize telemetry data.

The basinwide telemetry study in 2004 was also successful. A total of 995 fish were radio tagged from 3 June to 19 July with 811 of these radio tagged through June 30. Response by Chinook salmon to capture and handling was similar to previous results, with over 98% of the radio-tagged fish moving upriver after release. Analysis of the 2004 data is still in progress.

In conclusion, the overall project goals were met during the 2000-2004 study. Despite severe challenges, the logistical and technical aspects inherent with a study of this size and scope were effectively addressed. Initial work during 2000-2001 demonstrated that large-scale tagging studies were feasible. Technical improvements in the telemetry equipment used made it possible to effectively track fish moving upriver. Finally, information from the basinwide study has provided a better understanding of the timing, movements and distribution of Chinook returns in the drainage, and provided new insights for evaluating information from other assessment projects. The infrastructure provided by the project has also been used to facilitate additional studies on salmon and other fish species within the basin.

V. Products Study findings will be reported in Alaska Department of Fish and Game and National Marine Fisheries Service publication series, and made available on internet web sites. Technical reports and presentations were given to the Yukon River Joint Technical Committee and the Yukon Panel in 2000, 2001, 2002, and 2003. Project information has also been presented to the public at various regional advisory councils and YRDFA annual meetings. In-season reports and data summaries were provided to agency managers and fishing organizations. Updates were also presented during weekly teleconferences sponsored by YRDFA. An Internet web site, detailing telemetry information from the study, was made available to agency managers to facilitate data exchange in-season.

VI. References

Eiler, J. H. and R.R. Holder. Using radio telemetry to study Chinook salmon returns in the Yukon River Basin in Alaska, USA and Yukon Territory, Canada. In F. Schober (editor). Biotelemetry 16: Proceedings of the 16th International Symposium on Biotelemetry. Vienna Austria. International Society of Biotelemetry. Wageningen, The Netherlands. In press.

Spencer, T. R., R. S. Chapell, T. Hamazaki, and J. H. Eiler. 2003. Estimation of abundance and distribution of Chinook salmon in the Yukon River using mark-recapture and radio telemetry in 2000 and 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries Regional Information Report 3A02-37, Anchorage. 54 pp.

VII. Key Words: Chinook salmon, Yukon River, radio telemetry

10. ADMINISTRATIVE SUPPORT

Jan Gamble, Administrative Manager, Alaska Department of Fish and Game
US/Canada Yukon River Salmon Negotiations Studies
Award Number: NA03NMF4380185
Period Covered by the Report: From: July 1, 2003 To: June 30, 2004
Date Prepared: October 20, 2004

II. Executive Summary

Administrative support is an essential function for successfully managing a project. Successful administration is measured by remaining within the authorized budget amount, and within compliance of the terms and conditions of the contract. Administrators provide assistance and guidance to managers on projects with mandated federal and state procedures and policies. Administrative support is the backbone to a well-managed project and a tool for managers who work to fulfill the scope of work identified and defined by each project within this report.

III. Purpose of Project

The essential function of administrative support is the day-to-day operational assistance given to each project manager: reviewing, tracking, approving and processing of grant obligations and to provide training and guidance to all personnel directly involved with the Yukon River Negotiations Studies grant projects. The funding received is mandated through the Alaska Administrative Manual, State and Federal Procurement Codes, OMB Circulars A-87 and A-102 and Personnel Rules extensively.

Approved and authorized budgets are established during the period of performance, a fiscal year between July 1, of one year through June 30, the following year, and for each fiscal year following. The budgets established also contain account line items for the needs identified within each project and specific to the scope of work.

IV. Approach

All obligations generated by the Yukon River Negotiation Studies are processed for payment through the Alaska Statewide Accounting System (AKSAS) and the Alaska Payroll System (AKPAY). Technical working knowledge is necessary to ensure all policies and procedures established are followed and remain in compliance with each projects scope of work and terms and conditions of the contracts. This insurance is obtained through the Accounting Technician I and Administrative Supervisor and with the assistance of an Administrative Clerk III and Accounting Clerk II. Objectives for the Accounting and Human Resources functions are to maintain accuracy and accountability, and to remain in compliance with the terms and conditions of the contract. Each staff member attends the yearly workshop prepared and presented by NOAA administrators.

Accounting

Expenditures are entered daily into Expenditure Tracking System (ETS) and reconciled monthly against the Alaska Statewide Accounting System. Balancing expenditures from ETS to AKSAS for the month is a valuable tool for the managers. A monthly financial report is prepared utilizing the data obtained through the ETS program. This report compiles the year to date expenditures

and is distributed to each project. The report provides the projects authorized allocation and a year to date balance report of the verified (paid) and unverified (unpaid) expenses to the project managers. Expenditures provided in this report cover personal services, travel, contractual, supplies and equipment costs.

Mid-year audits are performed on each project and allow for review and adjustment in expenditures to prepare for the next phase of the project for the up coming field season. A report is prepared and reviewed at the Regional and Headquarters level.

Year-end reports are prepared and completed by September each year. This schedule allows adjustments and outstanding expenditures to be processed in the fiscal year expenses are generated.

Human Resources

The Administrative Supervisor provides assistance to project managers with all aspects of human resources support. This includes but is not limited to: recruitment, training, termination, employee benefits, contractual bargaining unit information, benefits, time and attendance, and employee orientation. Employee information is maintained in an in-house program called ADAM. This system allows the Administrative Supervisor to enter and track employee information such as pay range, merit, and longevity steps, enter on duty dates, termination dates, seasonal leave without pay dates, location (duty stations), bargaining units, financial project codes and retirement systems. Another in house program utilized is EVE, specifically used for the bi-weekly payroll process and calculates data entered from timesheets: time and attendance, premium pays, and non-paid hours.

Employee and financial information is essential to the successful management of personnel for the project managers. Data retained in the personnel ADAM system is used during each payroll process and is downloaded each pay period into the EVE timesheet program, and compared against employee information from ADAM. Timesheets received and entered into EVE are carefully reviewed, compared for differences and corrected if wrong. This dual program system ensures accurate entry and processing of bi-monthly payroll.

Evaluations and position descriptions are received and reviewed, and files maintained and processed by this position. Discrepancies and recommendations are made by this position with all aspects of the evaluations and position descriptions.

V. Evaluation

The goals and objectives of this project have been met. Project managers receive accounting support and are able to monitor daily and monthly expenditures through reports and assistance with procurement and contractual needs. Human resource assistance is provided in areas of time and attendance, evaluations and in monitoring essential personnel action. This project is successful as an administrative support project. The success is measured through the overall awards success. Staff supported by this project is quite large and the logistics of each field camp are unique. Staff administration is difficult for a large and diverse group, but this project provides accountability and accuracy by dedicated administrative support staff that manages the Yukon River Negotiation Studies grant.

11. KANTISHNA RIVER MARK-RECAPTURE

Bonnie Borba, Fall Chum and Coho Salmon Research Biologist, Division of Commercial Fisheries, Alaska Department of Fish and Game
NA06FP0075
Period Covered by the Report From: July 1, 2003 To: June 30, 2004
Date Prepared: November 3, 2004

II. Executive Summary:

The Kantishna River mark-recapture project is only part of a cooperative fall chum salmon stock assessment project. The full assessment of the Tanana River fall chum salmon stocks is conducted by the Alaska Department of Fish and Game with assistance from Bering Sea Fishermen's Association and National Park Service. The primary goal is to estimate the abundance of fall chum salmon in the Kantishna River (since 1999) in conjunction with the ongoing upper Tanana River (upstream of the Kantishna River since 1995) using mark-recapture techniques. A secondary goal is to estimate the migration rates of fall chum salmon within the Tanana River and determine the timing of selected stocks (e.g., the Toklat River) as they pass the tagging and recovery sites.

Management of fall chum salmon fisheries within the Yukon River is based primarily on estimates of abundance that are used to assess run strength and are provided by various projects throughout the drainage. Estimation of fall chum salmon abundance is essential for regulating subsistence, personal use, and commercial fisheries within the portion of the Yukon River drainage within Alaska while endeavoring to meet commitments for Canadian border passage in the mainstem Yukon, and to meet escapement objectives in the Porcupine River drainage. Since 1999, mark-recapture techniques have been employed to generate fall chum salmon abundance estimates on the Kantishna River. Because the Kantishna River, a major tributary of the Tanana River, is an important contributor of fall chum salmon stocks, and distribution of escapement between years can be significant, monitoring the abundance of fall chum salmon within the Kantishna River is important. The Kantishna River fall chum salmon estimate is used in conjunction with the estimate in the upper Tanana River drainage providing fishery managers with information necessary to substantiate total run size in the Yukon River drainage as a whole. Abundance estimates are generated inseason for fishery management purposes and provide required data for total run reconstruction. The Alaska Board of Fisheries has designated Yukon River fall chum salmon as a stock of "yield concern."

The population estimates of fall chum salmon gained from the Kantishna mark-recapture project along with the upper Tanana River drainage abundance estimates represents the majority of the stocks bound for the Tanana River. Management of fall chum salmon fisheries inseason are based on estimates of total run size initially assessed at Pilot Station using sonar followed by the mark-recapture studies within the Tanana River and Upper Yukon River drainage both of which provide insight into the distribution of the stocks in a given year. This budget provides partial funding for a mark-recapture project primarily providing tag recovery information that is crucial for producing the population estimates. This portion of the cooperative project provides for the Toklat River tag recovery crew and all the necessities for maintaining the camp in a remote portion of the drainage.

III. Purpose of Project:

The primary goal of the mark-recapture project is to provide an independent estimate of the total abundance of fall chum salmon passage in the Kantishna River (a major tributary of the Tanana River) and the upper Tanana River (upstream of the Kantishna River). The mark-recapture projects are operated concurrent with the use of historical postseason evaluation of escapements based on population estimates of the two index areas, the Toklat River Springs and the Delta River in the Kantishna and upper Tanana River drainages respectively. Secondary goals include collecting information on migration rates of fall chum salmon between the capture and recovery locations and estimates of stock timing to the Toklat Springs (within the Kantishna River) and Delta River (within the upper Tanana River drainage).

A substantial portion of Yukon River fall chum salmon production originates from the Tanana River, and stocks from this system contribute significantly to the subsistence, commercial, personal use and sport fisheries. Programs exist that provide inseason abundance estimates of fall chum salmon in the mainstem Yukon River (e.g., Yukon River sonar, Rampart mark-recapture) as well as in some of the tributary streams (e.g., Sheenjek and Chandalar River sonars). A growing concern during the past decade has been the lack of reliable inseason run assessment tools for evaluating the strength of the Tanana River fall chum salmon component. The strategy for addressing this concern was to expand the upper Tanana River mark-recapture project. With addition of the Kantishna River mark-recapture, all of the major Tanana River stocks are monitored low enough in the river system to apply the information to inseason fishery management. Prior to the mark-recapture projects on the Tanana River, evaluation could only be completed postseason using escapement estimates from stream surveys.

Fall chum salmon are very specific in their spawning habitat requirements in that they utilize primarily areas with upwelling groundwater that occur along the north side of the Alaska Range or south bank of the Tanana River. Mark-recapture techniques provide a better index of abundance, particularly in areas where "mainstem" spawning is prevalent, since only a few side channels of the Tanana River clear up enough to survey, and the majority of the areas are not easily accessible for conducting index counts. Silt laden waters as well as ice flow in the late fall also make it difficult to monitor. Attempts at operating sonar equipment on tributaries such as the Toklat River have proven to be difficult due to a combination of problems such as species apportionment (coho salmon and non-salmon species present), milling behavior closer to the spawning beds, and relevance to inseason application in the fishery.

IV. Approach:

Mark-recapture studies within the Tanana River drainage, based on tagging and recapturing fall chum salmon *Oncorhynchus keta* in proportion to abundance, were conducted from 1999 to 2003 on the Kantishna River and from 1995 to 2003 in the upper Tanana River stocks. Chum salmon were captured in a fish wheel on the left bank of the Kantishna River, approximately 9 km upstream of its terminus with the Tanana River. Spaghetti tags were applied, biological data was collected, and the fish were released back into the river. The fish continuing their migration up river were recaptured at additional sites that cordoned off the system; two fish wheels were located approximately 113 km upstream in the Toklat River (one on each bank), and two fish wheels were located 139 km upstream on the Kantishna River (one on each bank). Similarly on the upper

Tanana River, one tagging fish wheel was located 9 km upstream of the Kantishna River mouth, and one recovery fish wheel was located 76 km upstream near the community of Nenana. One crew of 3-4 Fish and Wildlife Technicians was used to tag chum salmon in both rivers based out of one field camp. Operational periods were from approximately 15 August to 30 September each season. Bailey abundance estimates of salmon passage were provided inseason for fishery management. Following postseason analysis, either Bailey or Darroch methods were used to provide final population estimates of chum salmon passage.

Cooperators include Bering Sea Fishermen's Association who has provided funding for the Kantishna River tagging fish wheel contract (let to a local resident of Tolovana River). Beginning in 2000, Gates of the Arctic National Park and Preserve also supplied funding for operation of the upper Kantishna River recovery fish wheel (let to a local resident of Kantishna River). ADF&G operates two recovery fish wheels on the remote Toklat River from this funding and provides funding from another source for the crewmembers who tagged the fish.

The Kantishna portion of the project (as an add on to the existing upper Tanana River mark-recapture) includes an additional two months salary for one Fishery Biologist II for extra work in conducting and analyzing data from the entire project. Two Fish and Wildlife Technicians are funded which live remote and operate the two recovery fish wheels on the Toklat River. All supplies for the field camp are provided by this funding source. Salaries for other Fishery Biologist IIs and IIIs, and Biometrics personnel who assist with data analysis and logistics are covered under other funding sources.

IV. Results, Evaluation and Conclusions:

Abundance estimates of chum salmon have been successfully provided each year, both inseason and postseason (Cleary and Hamazaki 2004, Cleary and Hamazaki 2003; Cleary and Hamazaki 2002a; Cleary and Hamazaki 2002b; Cleary and Bromaghin 2001). The final abundance estimates for the Kantishna River and upper Tanana River chum salmon are as follows:

Year	Kantishna River Point Estimate	Kantishna S.E.	Upper Tanana River Point Estimate	Upper Tanana S.E.
1999	27,199	3,562	97,843	19,362
2000	21,450	3,031	34,844	4,970
2001	22,992	2,172	96,556	20,955
2002	56,665	4,122	109,961	12,724
2003*	87,359	8,041	193,418	9,976
Average	43,133		118,781	

* Data is preliminary.

More years of data will be required to provide information to build a relationship between the long term historical Toklat Spring Index Area counts (1974 to present) and the Kantishna River abundance as a whole. The Upper Tanana River information includes data from 1995 to the present and has been used in run reconstruction for the Tanana River during development of the Yukon River fall chum salmon biological escapement goals (Eggers 2001).

Migration rates for tagged fall chum salmon to the recovery fish wheels:

Year	Toklat Fish Wheels km/day	Toklat Fish Wheels Sample Size (n)	Upper Kantishna Recovery km/day	Upper Kantishna Samples Size (n)	Tanana Recovery km/day	Tanana Recovery Sample Size (n)
1999	21	54	-	-	23	22
2000	27	33	27	11	23	45
2001	27	89	30	5	37	17
2002	26	165	21	14	29	69
2003*	15	85	16	26	24	34
Average	23	59	24	14	27	37

* Data is preliminary.

Stock timing for the Kantishna River tagged fish to the Toklat Springs Index Area and upper Tanana River tagged fish to the Delta River are as follows:

Year	Toklat Springs Median Tag Date	Toklat Springs Sample Size (n)	Delta River Median Tag Date	Delta River Sample Size (n)
1999	15 September	62	20 September	128
2000	11 September	35	30 August	16
2001	11 September	88	8 September	33
2002	19 September	252	13 September	100
2003*	5 September	89	3 September	31
Average	11 September	105	9 September	62

* Data is preliminary.

In terms of overall success, the goals and objectives were met for project year 2003. Abundance estimates of fall chum salmon in the Tanana River (1,269 km) in conjunction with the upper Yukon River abundance estimate (1,221 km) provide a check on the mainstem sonar estimate from Pilot Station sonar at river mile 123. In 2003 Pilot Station was thought to be overestimating both summer and fall chum salmon and extensive testing was completed during the summer season with unfortunately no conclusion with what was causing the affect. From 1997 to 2002 the difference between the total fall chum salmon run reconstruction based on Pilot Station sonar estimate and abundance estimates from other projects in the drainage ranged from 3% to 12% with an average of 8% however in 2003 the difference was 32%. Information from the mark-recapture project is used to prosecute fall chum salmon fisheries as well as being used to develop total run reconstruction, biological escapement goals, and preseason projections of returns.

V. Products

Project results have been reported in the following Regional Information Reports (RIR):

Bergstrom D.J., K.R. Boeck, B.M. Borba, A.L.J. Brase, F. Bue, W.H. Busher, J.S. Hayes, T.L. Lingnau, P. Salomone, and T. Vania. (In Prep), Annual Management Report, Yukon Area, 2003, Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region, 333 Raspberry Road, Anchorage, Alaska 99518-5526.

Joint Technical Committee of the Yukon River US/Canada Panel. 2004. Regional Information Report No. 3A04-09. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region, 333 Raspberry Road, Anchorage, Alaska 99518-5526.

Cleary, P.M. and T. Hamazaki, 2004. Estimation of fall chum salmon abundance on the upper Tanana and Kantishna Rivers using mark-recapture techniques, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region, 333 Raspberry Road, Anchorage, Alaska 99518-5526.

These reports were distributed to personnel with the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, National Park Service, Bering Sea Fishermen's Association and Canada Department of Fisheries and Oceans. Results have been reported to the U.S./Canada Joint Technical Committees, Yukon River delegate members and fishermen's groups through postseason and preseason fisheries meetings and State Advisory Committee and Federal Regional Advisory Committee meetings.

VI. References:

Cleary, P.M. and T. Hamazaki, 2003. Estimation of fall chum salmon abundance on the upper Tanana and Kantishna Rivers using mark-recapture techniques, 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A02-49, Anchorage.

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VII. Key Words: Tanana River, Kantishna River, Toklat River, chum salmon, mark-recapture, fish wheel, abundance estimate